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3,614,916

COMPACTING APPARATUS FOR FINISHING HOT MIX PAVEMENT

Filed April 13, 1970

3 Sheets-Sheet 1

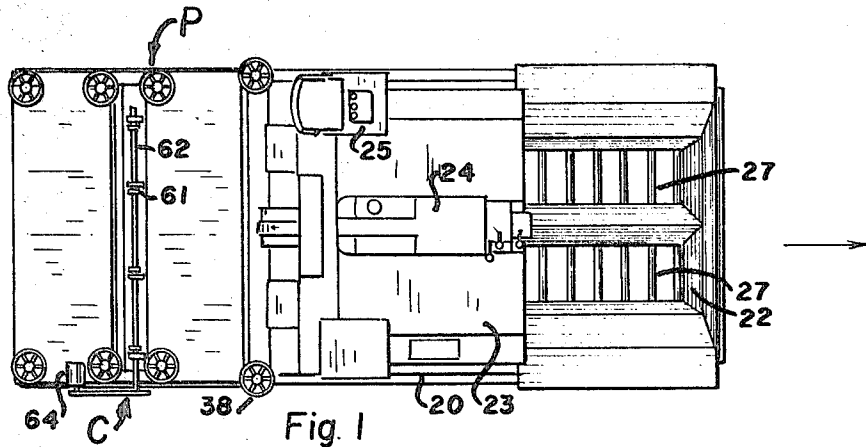


Fig. 1

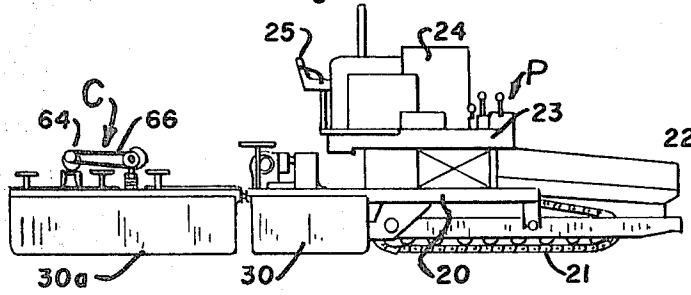


Fig. 2

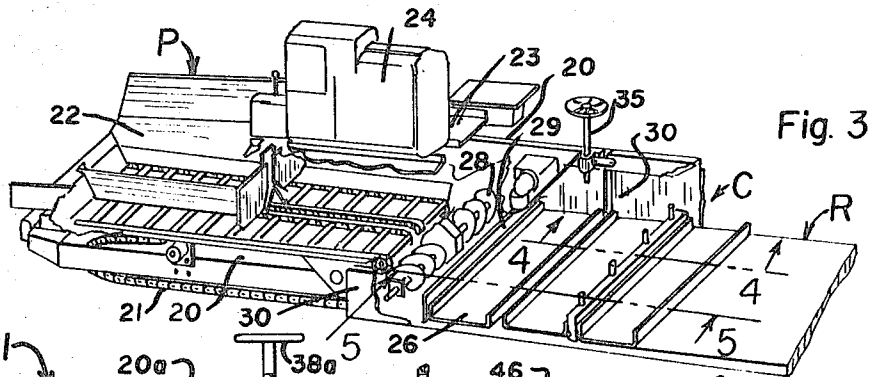


Fig. 3

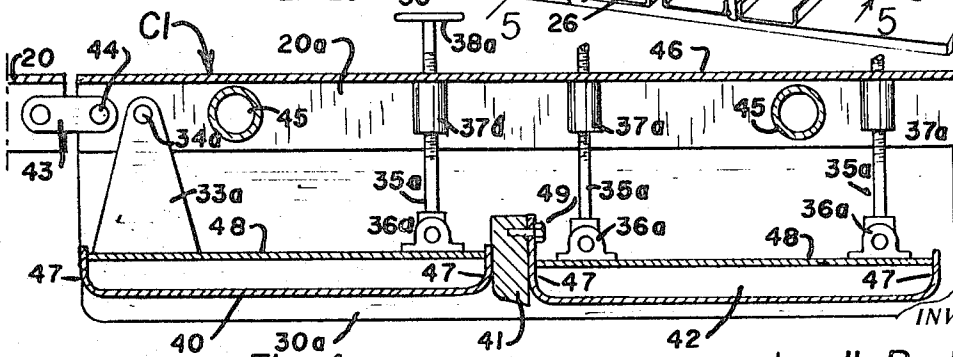


Fig. 4

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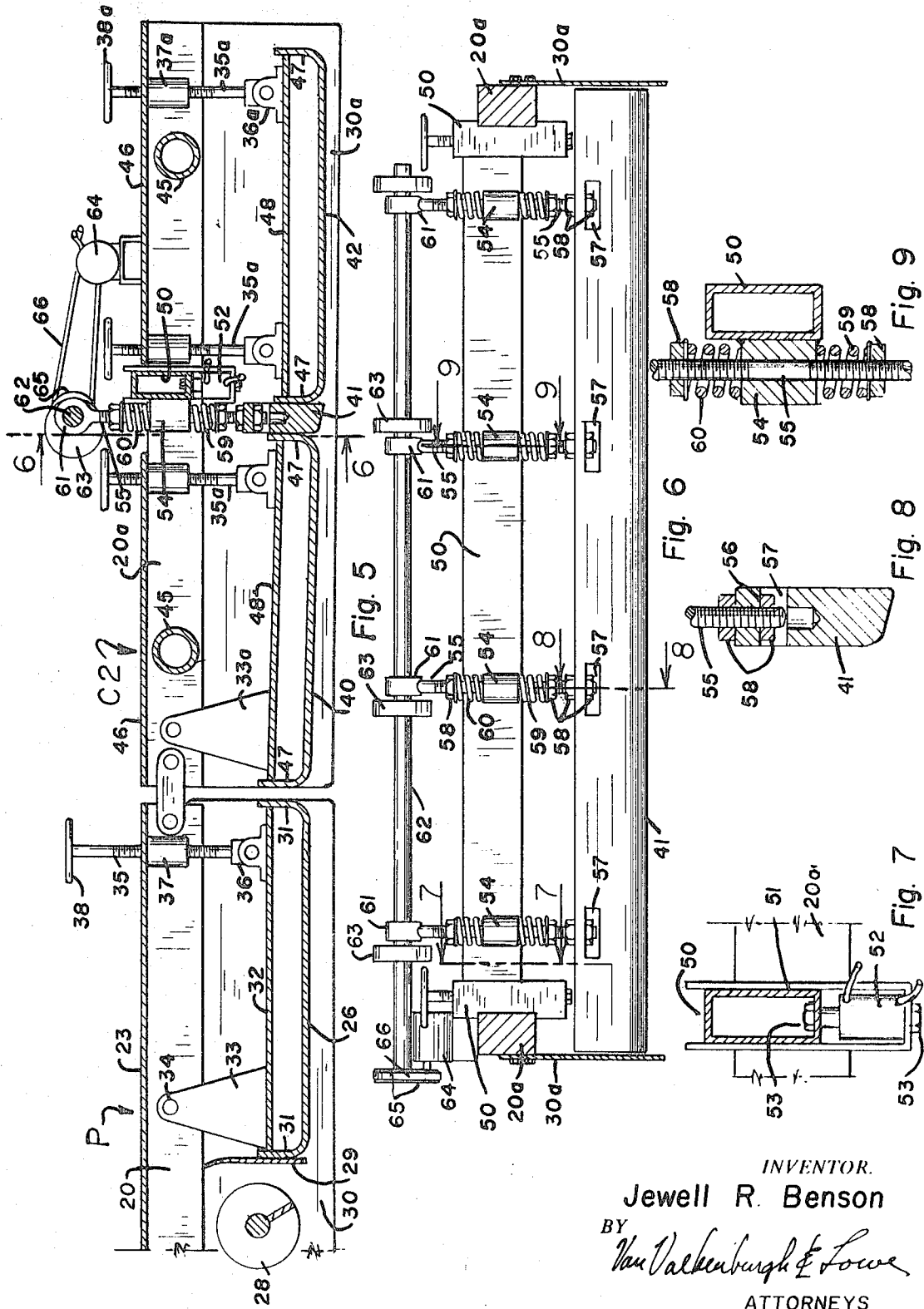
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

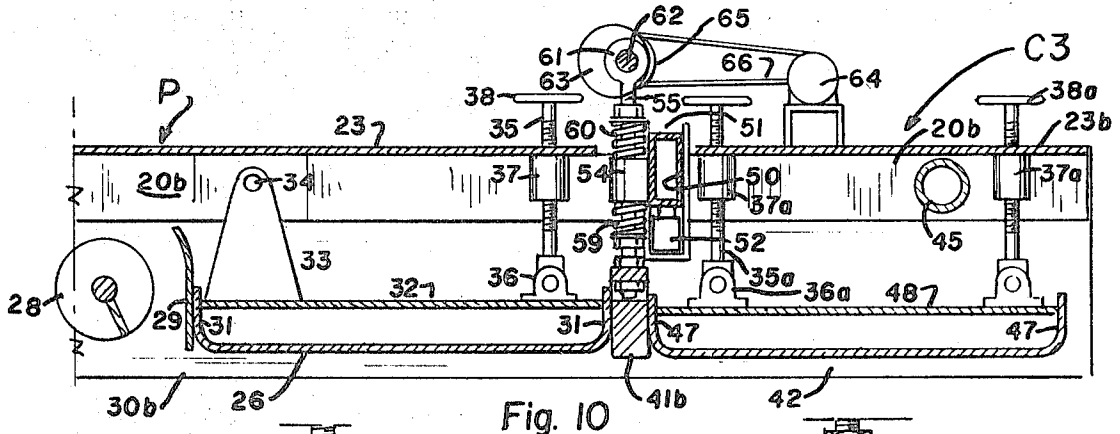


Fig. 10

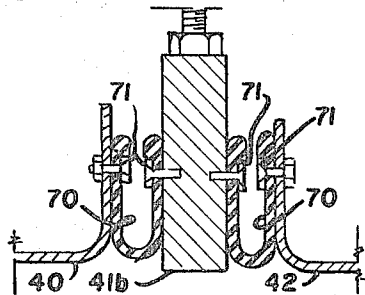


Fig. 11

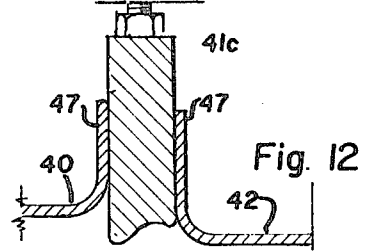


Fig. 12

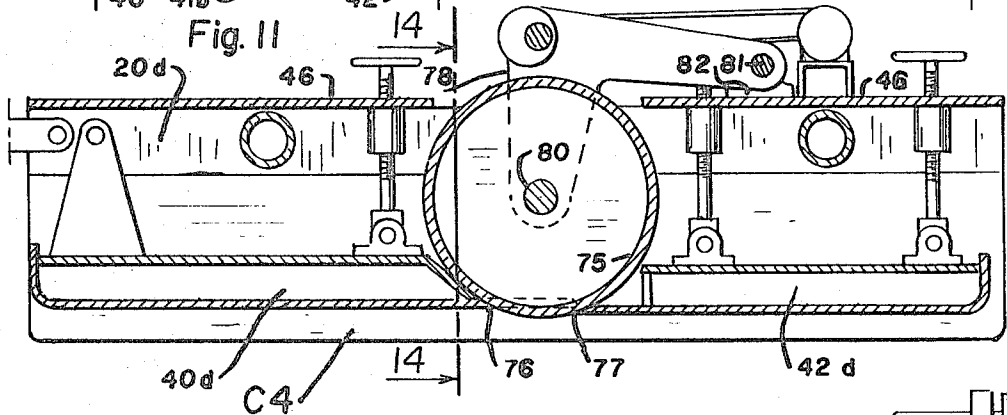


Fig. 13

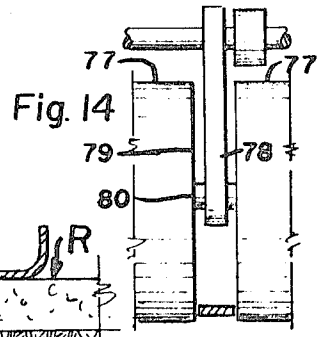


Fig. 14

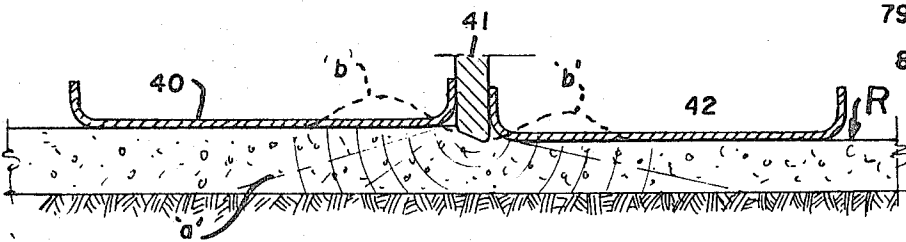


Fig. 15

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**COMPACTING APPARATUS FOR FINISHING
HOT MIX PAVEMENT**

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9 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus to follow a paving machine to better compact a ribbon of pavement formed by mixes of asphalt and aggregate. A compaction shoe traversing the pavement is confined between a leading surcharge plate and a trailing finishing plate. The pressure of the compaction shoe against the pavement which is sufficient to distort the pavement surface at each side of the shoe, effects the desired compaction because of the restraining action of the surcharge and finishing plates. To more effectively attain the desired compaction, a means is provided to vibrate the compaction shoe.

The present invention relates to the compaction of asphalt paving and more particularly to asphalt paving machinery, a primary object of the invention being to incorporate into an asphalt paving machine, a means for obtaining improved compaction of the asphalt pavement.

The technology of asphalt paving has developed from an operation where asphalt was mixed with aggregate, spread and then rolled to compact and complete the pavement. Later paving machines were developed to spread mixes, and especially hot mixes of asphalt and aggregate into a spread, or ribbon, of pavement as a single operation. Hot asphalt and aggregate are blended in various proportions and in many ways to produce mixes varying from a very stiff and difficultly workable type to an almost fluid type. Conventional paving machines cannot adequately compact many such types to produce a finished pavement. Accordingly, rollers are still used to extensively compact a pavement ribbon to increase its density to a desired value.

A roller is usually very heavy and may or may not be vibrated as it is used. While they will compact a pavement, rollers are not altogether satisfactory. Regardless of the type of roller used, the hot mix is usually too soft to permit rolling when it is first applied and the pavement must be cooled before it can be rolled. Otherwise, the roller will sink into the paving mix to cause cracks, rippling of the surface and a slipping apart of a top layer of asphalt without any bonding to the material therebeneath. This creates a dilemma, for when the pavement is cool enough to receive a roller, it is much more difficult to compact and frequently, maximum densities cannot be obtained.

In lieu of rollers, attempts have been made to attain compaction with conventional paving machines by vibrating the screed plates. A conventional paving machine receives a prepared hot mix material as from trucks. The hot mix is moved rearwardly through the machine to spread and finish a ribbon of pavement as the machine moves forwardly along a prepared road bed. The machine includes a spreader and a striker means to spread and strike off the material to a proper thickness and a finishing device at the trailing edge of the machine, ordinarily a screed. The screed, a flat plate extending transversely across the machine rides upon the surface of the paving ribbon to, essentially, trowel the surface to a flat layer while the mix is quite hot and easily worked. It has been demonstrated that the mere sliding of a flat screed plate

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across the finished surface is not sufficient to effectively compact the pavement. Accordingly, the screeds are also frequently provided with a vibration means, one type of vibrator being simply a heavy shaft carrying eccentric weights and extended across the machine to rotate at a high rate of speed.

However, such vibration devices have not been satisfactory. It is necessary to vibrate large masses of metal to obtain any significant compaction and the result is repeated equipment breakdowns. Also, it is impossible to make the equipment heavy enough to apply adequate unit pressure to the screed plate to produce an effective compaction. The screed plates are usually at least ten feet long and may be as much as three feet wide. Thus, the unit stress on the pavement under this plate is very low, in the range of one pound per square inch, more or less. Finally, the thickness of the paving ribbon which may be effectively compacted by vibration of the screed plate is limited and at best, can be only two or three inches.

The present invention was conceived and developed with the above and other considerations in view and comprises, in essence, a modified compacting apparatus for finishing and screeding hot mix pavement which operatively combines several components in tandem. These components include a surface pressure, or surcharge, plate, a compaction shoe and a finishing plate. Although when applying certain types of hot mix materials this arrangement of components is adequate to produce a good pavement, the invention further contemplates a means to provide vibration of the shoe or vibration and pressure of the shoe against the paving mix while it is hot, soft and easily workable. These actions of the shoe, pressure and/or vibration, combined with the restraining action of the surcharge plate and finishing plate, produce compaction of a pavement ribbon to a degree not heretofore attainable.

It follows that another object of the invention is to provide a novel and improved compaction apparatus for finishing a hot mix pavement which is adapted to lay a smooth, tight and dense ribbon of pavement.

Another object of the invention is to provide a novel and improved compacting apparatus which may be used in conjunction with a paving machine to more effectively compact and finish hot mix asphalt pavements and also other types of pavements which can be formed by the paving machine.

Another object of the invention is to provide a novel and improved compacting apparatus for finishing a ribbon of hot mix asphalt and aggregate to produce a pavement which will better and more consistently meet engineering specifications of desired compaction and density and which will produce a tougher, longer lasting pavement due to better particle orientation in the compacted mixture.

Another object of the invention is to provide a novel and improved method for forming a dense, tough pavement of hot mix asphalt and aggregate which combines simple steps without significantly modifying present paving operation sequences and minimizes the use of supplemental paving equipment such as rollers.

Another object of the invention is to provide in an asphalt hot-mix paving machine, a novel and improved apparatus for compacting and finishing a pavement ribbon which is capable of applying a high unit pressure to the surface of a hot mix asphalt as it is formed into a ribbon; effects compaction while the mix is still hot and easily workable; is capable of vibrating the mix under selected pressures, frequencies and amplitudes which will produce a maximum density of the pavement ribbon; and is capable of producing a compacted, well-finished ribbon of pavement much thicker than that which

can at present be compacted by conventional paving and compacting machinery.

Other objects of the invention are to provide in a hot mix asphalt paving machine a novel and improved finishing structure which: is a simple unit, is easily fitted on conventional machines and is an economical, rugged and durable arrangement of components.

With the foregoing and other objects in view, my invention comprises certain constructions, combinations and arrangements of parts and elements and sequences, steps and operations as hereinafter described in detail, defined in the appended claims, and illustrated in preferred embodiments in the accompanying drawings in which:

FIG. 1 is a plan view of a paving machine adapted to move in the direction of the indicated arrow when forming a pavement ribbon and having its trailing end modified to incorporate therein the improved compacting apparatus.

FIG. 2 is a right side elevation view of the paving machine shown at FIG. 1.

FIG. 3 is a perspective left-side, phantom view of the paving machine illustrated at FIGS. 1 and 2 to better depict the manner in which a hot-mix of asphalt and aggregate is dumped into the front end of the machine, to be moved rearwardly, spread, formed into a pavement ribbon and compacted by the improved apparatus at the rear of the machine.

FIG. 4 is a longitudinal sectional view through the rear portion of the paving machine, as taken from the indicated line 4—4 at FIG. 3, but on an enlarged scale and illustrating a simple, basic embodiment of the invention suitable for use with certain very soft types of pavement mixes.

FIG. 5 is a longitudinal sectional view through the rear portion of the paving machine, as taken from the indicated line 5—5 at FIG. 3, but on an enlarged scale and illustrating another embodiment of the invention wherein the compacting apparatus trails the paving machine and means are provided to vibrate the compaction shoe.

FIG. 6 is a transverse sectional view of the rear portion of the paving apparatus as taken from the indicated line 6—6 at FIG. 5.

FIGS. 7, 8 and 9 are fragmentary sectional details as taken from the respective indicated lines 7—7, 8—8 and 9—9 at FIG. 6, but on a further enlarged scale.

FIG. 10 is a longitudinal sectional view through the rear of the paving machine similar to the showing at FIG. 5, but illustrating a third embodiment of the invention wherein the compacting apparatus is incorporated into the paving machine.

FIGS. 11 and 12 are fragmentary sectional details similar to FIG. 8, but illustrating alternate constructions of the compaction shoe.

FIG. 13 is a longitudinal sectional view through the rear of the paving machine similar to the showing at FIG. 5, but illustrating a fourth embodiment of the invention wherein the compacting apparatus employs a roller instead of a shoe.

FIG. 14 is a fragmentary detail view as taken from the indicated line 14—14 at FIG. 13.

FIG. 15 is a diagrammatic longitudinal sectional view similar to FIG. 5, but illustrating only the basic components which are effective in compacting a pavement ribbon, and indicating further by dashed lines, the influence of the compaction shoe upon the pavement ribbon and in dotted lines the manner in which the pavement would bulge if it were not confined by the plates at each side of the compaction shoe.

Referring more particularly to the drawing, FIGS. 1, 2 and 3 show a conventional paving machine P which is modified at its trailing end to include an improved compactor C. In operation, the paver P moves forward at a slow rate to form a ribbon R of pavement while materials are fed into the leading end of the paver as

needed. The proportions of the paving machine P may vary considerably depending upon the particular make of the machine being used. However, these pavers are usually designed to finish a ribbon of pavement of a selected width, which, ordinarily, will be not less than ten feet.

The body of the paver P includes two longitudinal beams 20 which are at opposite sides of the paver to extend forwardly and rearwardly from the center of the unit. A crawler track 21 is secured to the underside of each beam 20 to support the forward portion of the machine while the rear portion will float on a screed as hereinafter described. A loading hopper 22 is located at the front end of this machine to receive hot mix material from supply trucks or the like as a pavement ribbon is being formed. A main deck 23 is mounted upon the beams 20 over the central portion of the machine and a motor 24 and operators station 25 are located upon this deck. The pavement is conventionally finished by a screed 26 which extends transversely across the rear portion of the machine underneath this deck, as shown at FIGS. 3 and 5 and as will be further described.

The components within this paver P, which move the hot mix from the hopper 22 to the road bed and thence underneath the paver to the screed 26, are best shown at FIG. 3. These components include conveyor belts 27 at the floor of the hopper which extend rearwardly therefrom to a dropoff point underneath the deck 23 ahead of the screed 26. There, the hot mix is spread laterally as by a spreader screw 28. A transversely extended strike-off plate 29 is located behind the header screw 28 and immediately ahead of the screed 26 to further spread and control the amount of hot mix material deposited upon the road bed which passes underneath the screed. The belts 27 and the spreader screw 28 move and rotate at selected speeds correlated with the forward movement of the machine to distribute the proper amount of hot mix material in front of the strike-off plate 29 and the screed 26 to permit the screed 26 to ride upon the hot mix and thereby form a finished ribbon of pavement of a selected thickness. To complete this arrangement, the spreader screw 28, the strike-off plate 29 and the screed 26 are confined between longitudinally extended side plates 30 which depend from the outer face of a beam 20 and extend downwardly a short distance below the undersurface of the screed. Accordingly, when the screed forms a ribbon of pavement from a hot mix of asphalt and aggregate, the plates 30 form the edges of the ribbon.

A typical structural arrangement of the spreader screw 28, strike-off plate 29 and screed 26 is illustrated at FIG. 5. The spreader screw is suspended from the framework of the apparatus in any suitable manner not shown. The strike-off plate may be likewise suspended from the framework or attached to the leading edge of the screed 26 as illustrated. This screed 26 is formed as a flat, rectangular plate having a width of eighteen to twenty-four inches and extending transversely across the machine. It is formed generally as an elongated, shallow pan having its leading and trailing edges upturned to form flanges 31 which provide for structural rigidity in the transverse span between the framework beams 20 from which the screed is suspended. This screed 26 is covered by a plate 32 to provide a chamber within it wherethrough hot gases are passed to preheat the apparatus before it is put into operation. The leading edge of this screed 26 is suspended from each beam 20 by an arm 33 upstanding from the cover plate 31 and connecting with a pivot 34 at the inner face of each beam 20. The trailing edge of the screed is suspended from each beam 20 by an adjusting screw 35 connected to a cover plate 32 by a pivoted head 36 to extend upwardly therefrom through a threaded sleeve 37 affixed to the inner face or the end of the beam 20. A handle 38 is provided at the top of the adjusting screw so the operator may easily change the slope of the screed.

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A number of other conventional components, not shown, are included in this paver. Elevational adjustments of the beam 20 to the track 21 are provided. Other adjustments are also provided to raise or lower the body and main beams of the unit with respect to the crawler tracks 21 to assist in establishing the thickness of a finished pavement ribbon. A guide means may be suspended over a road section alongside the paver to hold the grade and to thus control and to regulate the infeed of material deposited in front of the finished screed. A heating system is provided for the screed 26 and in other components which handle the hot mix. The heating of the apparatus is necessary to prevent the screed from tearing the pavement and the asphalt from otherwise clogging the machinery. The motor 24 has various leads and drives associated with it and controls at the operator's station 25 to effect proper movement of the apparatus. The screed 26, suspended from the rear ends of the beams 20, is adapted to be tilted by the adjusting screw 34.

The paver is easily modified to be used with the present invention and its basic organization need not be changed. An improved compacting assembly C is mounted at the trailing end of the paver 26 and it may be an independent unit towed by the paver or it may be combined with the screed 26 as hereinafter described. FIG. 4 shows a compactor C1, a simplified form of the apparatus. FIGS. 5 and 6 show a compactor C2, which is essentially the same arrangement as the compactor C1 shown at FIG. 4, but with a vibrator added. FIG. 10 shows a compactor C3 which is combined with the screed 26. FIG. 13 shows a compactor C4, which is somewhat similar to that shown at FIG. 5, but incorporating a roller into the unit.

In the construction shown at FIG. 4, the compactor C1 extends transversely across the trailing end of the paver to be connected thereto and to be towed by the paver. This compactor includes in a tandem arrangement, a leading surcharge plate 40, a relatively narrow compaction shoe 41 and a trailing finishing plate 42. These members are adjustably mounted upon a pair of longitudinally extended beams 20a as hereinafter described. Each beam 20a is at a side of the apparatus and is substantially in alignment with the beam 20 of the paver to permit it to be connected with the paver beams for towing the compactor. This connection is effected by a link 43 having each end pivotally secured to a beam by a pin 44 whereby to permit slight raising and lowering of the compactor with respect to the paver.

The beams 20a are held in spaced parallelism and are secured to each other through transverse structural members 45, illustrated as pipes welded to the inner faces of the beams. Deck plates 46 extend transversely across the beams to permit an operator to move back and forth across the apparatus without being unduly exposed to the heat of the asphalt therebelow. To complete the framework of this compactor C, a plate 30a is secured to each beam 20a, preferably at its outward face, to depend therefrom in alignment with a side plate 30 heretofore described, to continue to confine the edges of a pavement ribbon while the compactor moves over the ribbon.

The surcharge plate 40 and the finishing plate 42 extend transversely across the apparatus. Each may have a width in the approximate range of twelve to twenty-four inches and if desired, the plates may be built the same as the plate forming the screed 26. Following such pattern, each is formed as an elongated shallow pan having the leading and trailing edges upturned to form flanges 47, similar to flanges 31, to provide for structural rigidity in the transverse span between the framework beams 20a from which the plates 40 and 42 are suspended. Each is covered by a plate 48 to provide a chamber within it where through hot gases may be passed to preheat the apparatus before it is put in operation. Since the basic structural arrangement of the plates 40 and 42 is substantially the same as that of the screed plate 26, the same type of conventional

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means may be used for preheating the plates 40 and 42. Accordingly, such a preheat means is not shown.

The surcharge plate 40 may have substantially the same adjustment controls as the screed 26 and is adapted, primarily, to be adjusted to a level or inclined position. The leading edge of the surcharge plate 40 is suspended from each beam 20a by an arm 33a upstanding from the cover plate 48 to connect with a pivot 34a at the inner face of the beam 20a. Also, the trailing edge of the surcharge plate is suspended from each beam 20 by an adjusting screw 35a connected to the cover plate 48 by a pivoted head 36a and extending through a threaded sleeve 37a affixed to the inner wall of the beam 20a. Also, a handle 38a is provided at the top of the adjusting screw for the convenience of the operator.

The finishing plate 42 will require a more varied degree of adjustment beyond mere tipping because in some types of hot mix pavement, it may be necessary to lower this plate perhaps as much as an inch below the level of the undersurface of the surcharge plate. Accordingly, both the leading end and the trailing end of this finishing plate 42 are suspended from each beam 20 as by an adjusting screw 35a connected to the cover plate 48 by a pivoted head 36a and extending through a threaded sleeve 37a affixed to the inner wall of the beam 20a and with a handle 38a at the top for the convenience of the operator, but the handles are not shown at FIG. 4 to conserve space.

The compaction shoe 41 extends transversely across the compactor as an upright, narrow, comparatively-rigid bar of metal between the surcharge plate 30 and the finishing plate 32. It may be supported in any convenient manner. In the construction illustrated at FIG. 4, this compaction shoe is affixed to the leading flange of the finishing plate 42 as by a row of bolts 49. The under edge of the compaction shoe is shown as being level with the undersurface of the finishing plate 42 but adjustment means, not shown, may also be provided for connecting this compaction shoe to the finishing plate to lower it below the level of the finishing plate if desired.

In the FIG. 4 construction, the compaction shoe is an interrupting element between the undersurfaces of the surcharge plate and the finishing plate. With the surcharge plate and the finishing plate being adjusted to slightly different levels such, for example, as with the finishing plate being $\frac{1}{4}$ inch below the surcharge plate, and the bottom of the compaction shoe being aligned with or slightly below the undersurface of the finishing plate, a significant disruption of the freshly formed hot mix of asphalt and aggregate will be produced by the forward movement of the apparatus. A number of comparatively soft, almost fluid hot mix blends of asphalt and aggregate will be effectively compacted by this disruption when its action is combined with the restraining action of the surcharge plate and the finishing plate ahead of and behind the compaction shoe. Should the pressure on the apparatus need to be increased to make the compaction shoe operate more efficiently, the deck of the compactor C1 may be loaded with weights, and it is to be noted that the unit pressures on the surcharge and finishing plates will not be increased greatly but that there can be, through adjustments if necessary, a substantial increase of unit pressure upon the narrow compaction shoe.

The compactor C2 illustrated at FIG. 5, is built similar to the compactor illustrated at FIG. 4, having a surcharge plate 40, a compaction shoe 41 and a finishing plate 42, the plates being suspended from frame beams 20a the same as heretofore described. The leading edge of the surcharge plate 40 may be pivotally suspended from the frame beams 20a by arms 33a and its trailing edge may be adjustably suspended by an adjusting screw 35a. Likewise, the finishing plate 42 may be adjustably suspended between the frame beams 20a at the leading and trailing edges by adjusting screws 35a. The compaction shoe 41, however, is suspended independently from the plates by an arrange-

ment of components which vibrate this shoe upon a freshly formed ribbon of pavement.

This arrangement of components is carried upon a transverse beam 50 which extends between the beams 20a with each end being mounted in a vertical slot-like pocket 51 so that this beam 50 may be raised and lowered to any desired position. A mechanism at each end of the beam, to raise and lower it, is illustrated as being a double-acting, hydraulic jack 52 having its base secured to a floor in the beam and its piston secured to the beam itself as by mounting nuts 53, as shown at FIG. 7. Conventional pressure means, not shown, are used to actuate the pistons to raise or lower this beam. Also, if desired, screw jack types of actuators may be used in lieu of the hydraulic jacks 52, the actuator functioning the same to raise or lower the beam 50 to any desired position.

An array of sleeves 54 are secured to a face of the suspension beam 50 as a regular spacing across the beam and threaded slide rods 55 are mounted in these sleeves. The base of these rods connect with the top of the compaction shoe as in sockets 56 as illustrated at FIG. 8. These sockets 56 open into pockets 57 in the shoe so that lock nuts 58 may be affixed to the rods at the top of the shoe and within the pockets to tightly secure the rods in position once they are adjusted. Each rod, extending upwardly from the adjusting screw, extends through a spring 59, thence through the sleeve 54, thence through another spring 60 and to a bearing head 61 at its top. The springs 59 and 60 are adjustably tightened against the upper and lower surfaces of the sleeves 54 by lock nuts 58 and accordingly, the lower spring 59 may be tightened to increase the downward pressure of the shoe as against a pavement ribbon while the upper spring 60 may be tightened to lift the shoe. It is apparent that considerable adjustments are possible with these springs. For example, the springs 59 may be adjusted to produce a steady downward pressure of the shoe against the pavement and the compactive effects may then be increased by the vibratory actions added thereto. Also, they may be adjusted so that the springs do not exert any substantial pressure against their sleeves or they may be adjusted so that there is considerable pressure against the sleeves. Such adjustments will control the nature and amplitude of the vibration of the shoe 40, a tight adjustment limiting the amplitude while a loose adjustment will permit a greater amplitude and even a percussion action of the shoe against the pavement. These various actions can be advantageously selected for use with various different types of mix.

The bearing heads 61 carry a transverse shaft 62 extending across the top of the apparatus and it is to be noted that the length of the rods 55 must be adjusted with respect to each other to receive the shaft 62. A heavy eccentric 63 is secured to the shaft 62 adjacent to each rod bearing 61 and these eccentrics are positioned upon the shaft 62 in the same manner so that with rotation of the shaft, they will act in unison.

A suitable means for rotating the shaft 62 includes a hydraulic motor 64 mounted upon one of the frame beams 20a to upstand from the deck surface of the unit. This motor is connected to the shaft 62 through pulleys 65 and a belt 66. A hydraulic motor is especially suitable for this purpose, since it is a low cost, powerful unit, and hydraulic power lines are generally available for operating equipment for driving the motor. It can be easily run at various selected speeds to adjust the apparatus to operate best with any particular type of mixture the apparatus is compacting. It is to be noted that the rotation of the eccentrics 63 will not only create vertical components of vibration, but will also tend to create horizontal components of vibration which must be restrained by the sleeve mounts 54. Accordingly, these sleeves may include a resilient core, not shown, to better absorb and minimize the effects of the horizontal components of vibration caused by the rotating shaft 62.

The versatility of this apparatus is now manifest be-

cause when in the field, finishing a mixture having a certain consistency and softness, the tightness of the springs 59 and 60 and the speed at which the compaction shoe vibrates can be quickly and easily adjusted to most effectively compact the pavement. At the same time, the inclination of the surcharge plate, the elevation of the vibrating shoe and the elevation of the finishing plate can be easily adjusted for the best compaction action. Once adjusted, the compactor C2 can move along a roadway at a uniform speed to form a compact, uniform ribbon of pavement without any significant further adjustments.

The compactor C3 illustrated at FIG. 10, modifies the paving machine to incorporate within it the conventional screed 26, the compaction shoe 41 and a finishing plate 42. Thus, this arrangement eliminates the surcharge plate 40 and instead, the conventional screed 26 functions as the surcharge plate. As a first modification, the frame beams 20b extend beyond the end of the screed 26 to support the compaction shoe 41 and the finishing plate 42. The compaction shoe 41b is formed with a different bottom than that heretofore described, but is otherwise the same and is carried by rods 55, mounted in sleeves 54 of a transverse beam 50, as heretofore described. The upper ends of the rods 55 terminate as bearing heads 61 and a shaft 62 is carried in these bearing heads, to carry eccentric weights 63 adjacent to each bearing head. Also, this shaft 62 is driven by a motor 64, as heretofore described.

Likewise, the finishing plate is suspended from the beams 20b at the front and at the rear ends by lead screw arrangements 34 as heretofore described and the side edges of the arrangement are enclosed with edging plates 30b to extend to the trailing end of the unit.

Operation of this modified compactor C3 is substantially the same as that attained by the unit illustrated at FIG. 5. As material is spread by the lead screw 28 and troweled to depth by the striker 29, it is then passed underneath the screed 26, which functions as the surcharge plate heretofore described to restrain material being compacted by the shoe 41b.

It is contemplated that in all instances, the compaction shoe 41 will fit snugly in the slot between the trailing flange 47 of the surcharge plate 40, or flange 31 of the screed 26 and the leading flange 47 of the finishing plate 42. The snug fit will prevent an unreasonable amount of hot asphalt or fine material to flow upwardly in the spaces between the plates. However, a means may be provided for eliminating this flow of material completely. The arrangement shown at FIG. 11 provides for a flexible diaphragm 70 between each flange and the adjacent walls of the compaction shoe. The diaphragm may be of silicon rubber or any similar material of a type able to withstand the high temperatures encountered by contact with the hot mix of asphalt. In this arrangement, each diaphragm 70 is formed as an elongated strip extending completely across the apparatus having one side bolted to the flange 47, or 31, of the adjacent plate or screed, and the other edge bolted to the wall of the compaction shoe as with tie strips 71 in the manner clearly illustrated at FIG. 11.

In the construction best illustrated at FIG. 8, the undersurface of the compaction shoe 41 is shown as being curved and inclined downwardly in the direction of the movement, however, while such a slope is generally desirable, this is not essential. FIGS. 10 and 11 show a compaction shoe 41b having a flat undersurface while FIG. 12 shows a compaction shoe 41c where the curvature of the undersurface is reversed. Actually, the configurations can best be established by the properties of the mixture and the type of compactive effort selected and used. For example, where a very stiff mix is used, it is more desirable to use a sloping undersurface similar to the shoe illustrated at FIG. 8. On the other hand, where a soft mix is used, the reverse curvature shown

at FIG. 12 may be desirable to attain a greater depth of compaction as vibration pounds the shoe against the surface of the pavement ribbon.

The modified construction of a compactor C4, shown at FIGS. 13 and 14, includes many of the same features shown in the compaction shoe C2, FIG. 4. However, a vibrating roller 75 is used instead of a compaction shoe. A surcharge plate 40d and a finishing plate 42d are suspended from beams 20d, the same as heretofore described. In this modified construction, the trailing edge 76 of the surcharge plate 40d and the leading edge 77 of the finishing plate 42d are feathered to the under-surface to fit snugly against the roller 75 and especially with the leading edge 77 of the finishing plate forming a scraper to better keep material from adhering to the surface of the roller.

The roller 75 is held in position by a transverse array of L-shaped levers 78, each having one end thereof extending into a slot 79 between roller sections for mounting upon a central roller shaft 80 of the roller as best illustrated at FIG. 14. The other end of each L-shaped lever 78 is secured to a transverse shaft 81 mounted above the deck 46 of the compactor as in bearings 82. The elbow portion of the lever 78 carries a vibration inducing shaft 62d which is driven by a motor 64 through a pulley belt arrangement as heretofore described to rotate eccentrics 63d carried on the shaft 62d adjacent to each lever 78. In operation, it is manifest that this apparatus will function very similar to the compaction shoe heretofore described. If additional pressure of the roller against the pavement is desired, the arms 78 may be loaded.

FIG. 15 illustrates in a diagrammatic manner, the effect of the combined action of the surcharge plate 40, the compaction shoe 41 and the finishing plate 42. The compaction shoe, vibrating independently of any movement of the surcharge and finishing plates, can exert a substantial pressure upon the pavement immediately underneath the shoe in addition to vibrationally working the hot mix. The vibration will, to a considerable extent, fluidify the mixture with pressure effects emanating from the shoe somewhat in the manner indicated by the wave lines a. Compaction of soft or loose material is possible because of the restrictive effects of the plates 40 and 42. Without the restriction by the surcharge plate 40 and the finishing plate 41, the pavement at each side of the shoe would not compact but would merely yield into leading and trailing humps as shown by the dotted lines b. The influence of the compaction shoe 41 will extend a substantial distance in each direction depending upon the type and thickness of the pavement and the intensity of pressure and of vibration of the shoe. The width of the plates 40 and 42 must be sufficient to confine this influence and a minimum width of plate possible is approximately four times the thickness of pavement being formed.

I have now described my invention in considerable detail. However, it is obvious that others skilled in the art can build and devise alternate and equivalent constructions which are nevertheless within the spirit and scope of my invention. Hence, I desire that my protection be limited not by the constructions illustrated and described, but only by the proper scope of the appended claims.

I claim:

1. A compactor adapted to extend transversely across and to be moved longitudinally over a pavement ribbon of an incompletely consolidated mixture of binder and aggregate to further consolidate the same and comprising:

(a) a leading surcharge plate adapted to ride upon the incompletely consolidated ribbon and having a width sufficient to restrain the materials forming the ribbon from upheaval underneath the plate whenever the material adjacent to the trailing edge of the plate are compacted;

- (b) a comparatively narrow compaction shoe having its leading edge at the trailing edge of the surcharge plate, the width of the compaction shoe being such that it may exert a downwardly-directed, densifying pressure and compaction upon the incompletely consolidated pavement ribbon;
- (c) a trailing finishing plate having its leading edge at the trailing edge of the compaction shoe and having a width sufficient to restrain the materials forming the ribbon from upheaval underneath the plate whenever the materials adjacent to the leading edge of the plate are compacted;
- (d) a framework carrying the aforesaid surcharge plate, compaction shoe and finishing plate; and
- (e) means associated with the framework for adjusting the elevation and the inclination of the surcharge plate, the elevation of the compaction shoe and the elevation and inclination of the finishing plate with respect to each other and with respect to the pavement ribbon, whereby to permit the plates to conform with the changing elevational configuration of the ribbon as it is compacted by the shoe to provide an optimum unit pressure of the compaction shoe against the pavement ribbon and at the same time sufficient pressure upon the ribbon underneath the surcharge and finishing plates to prevent upheaval of the ribbon at either side of the compaction shoe.
2. In the organization defined in claim 1, wherein: the surcharge plate has a width not less than approximately four times the thickness of the pavement ribbon; the compaction shoe has a width which may be less than, but is not significantly greater than, the thickness of the pavement ribbon; and the finishing plate has a width of not less than approximately four times the thickness of the pavement ribbon.
3. In the compactor defined in claim 1, including: a means to vibrate the compaction shoe.
4. In the compactor defined in claim 3, wherein said means to vibrate the compaction shoe includes: vibration inducing means to induce substantially vertical vibrations at a selected frequency; and resilient restraining means to control the amplitude of the vibration.
5. In the compactor defined in claim 1, wherein: small spaces exist between the compaction shoe and the adjacent surcharge plate and finishing plate; and the compaction shoe and the surcharge plate and finishing plate are interconnected by a diaphragm means at the spaces between them to prevent pavement material being contacted from flowing between such spaces.
6. The compactor defined in claim 1, including in combination therewith:
- a paving machine adapted to receive the binder and aggregate materials at its leading end and to convey and spread the mixture upon a roadbed as a ribbon of substantially uniform thickness as the machine moves forwardly; and
- a strike-off means to control the thickness of the pavement ribbon as the material is spread and wherein said compactor trails the aforesaid strike-off means.
7. In the compactor defined in claim 1, wherein: said framework is generally rectangular and includes: a longitudinal beam at each side thereof; a first means depending from each beam to connect with the surcharge plate; a second means mounted upon the beams to support the compaction shoe; and a third means depending from each beam to connect with the finishing plate.
8. In the compactor defined in claim 7, wherein: the aforesaid second means comprises a transverse beam between the longitudinal frame beams

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a plurality of rods slidably carried upon the transverse beam to depend therefrom and to connect with the compaction shoe; and

vibration inducing means associated with the rods adapted to transmit vibrational impulses through the rods to the compaction shoe. 5

9. In the compactor defined in claim 8, wherein:

resilient means hold the rods upon the transverse beam; and wherein

the transverse beam is elevationally adjustable with respect to the longitudinal beams whereby to vary the elevation and pressure of the compaction shoe with respect to the aforesaid plates. 10

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