United States Patent

[11] **3,545,349**

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Nov. 18, 1965, abandoned.
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[32] Priority **Nov. 26, 1964**
[33] **Germany**
[31] **No. 1,459,670**

[54] **SELF-PROPELLING PAVING MACHINE**
4 Claims, 14 Drawing Figs.

[52] **U.S. Cl.** **94/46**
[51] **Int. Cl.** **E01c 19/48**
[50] **Field of Search** 94/45, 46

[56] **References Cited**
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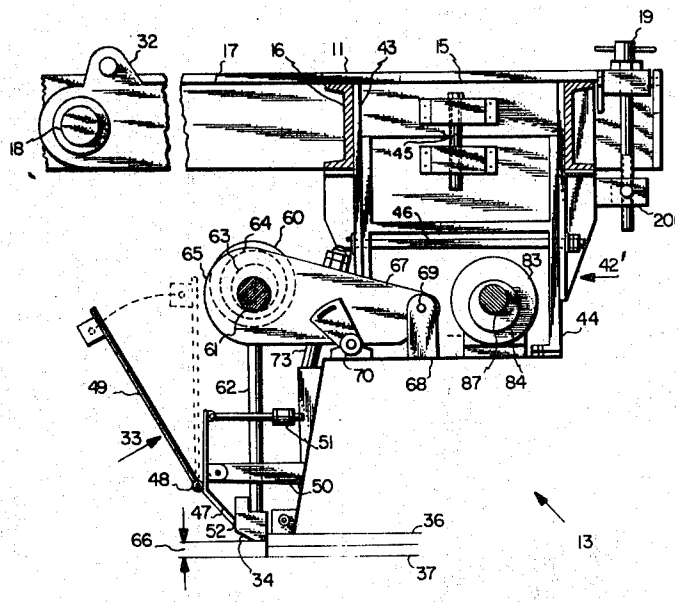
ABSTRACT: Automotive road finishing machine for a mechanized distribution and compacting of road building material for road construction having a frame with a front plate secured thereon and a tamping beam movable vertically and arranged on the frame together with a smoothing screed. The impact height of the tamping beam is adjustable and a plurality of vibrators on the smoothing screed are operable as to their frequency which is maintained independent of the impact rhythm of the tamping beam.



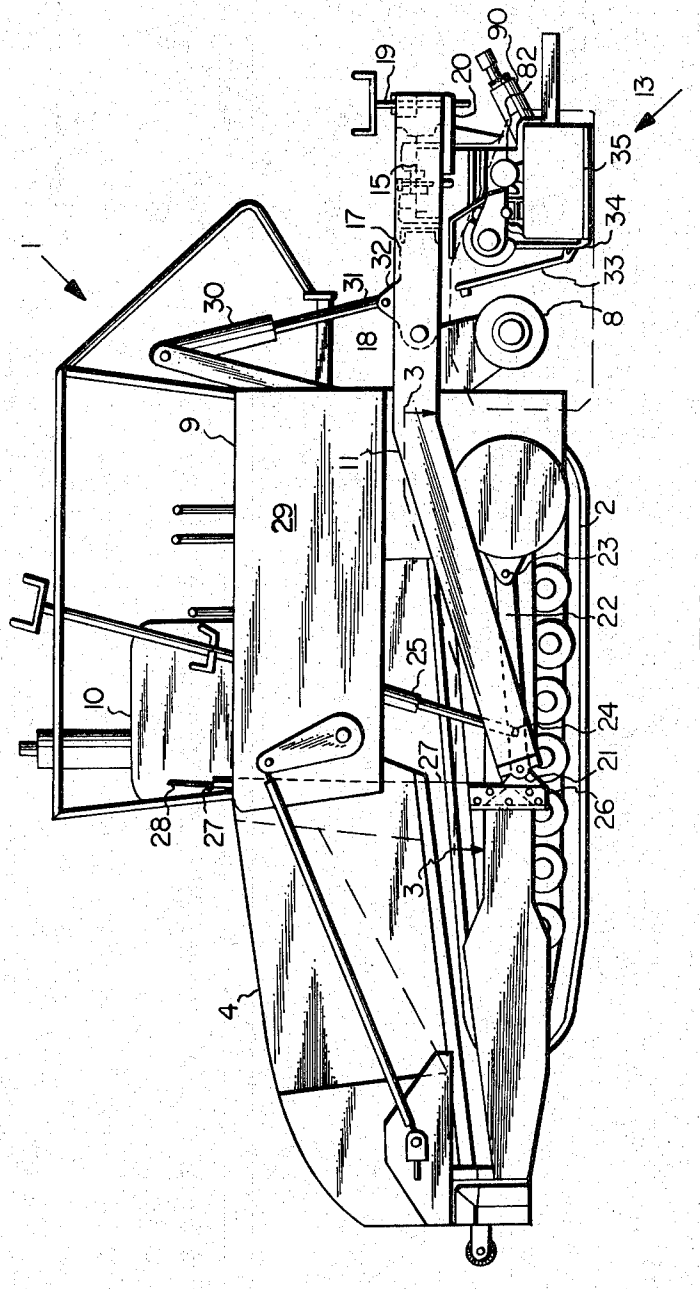


FIG. 1

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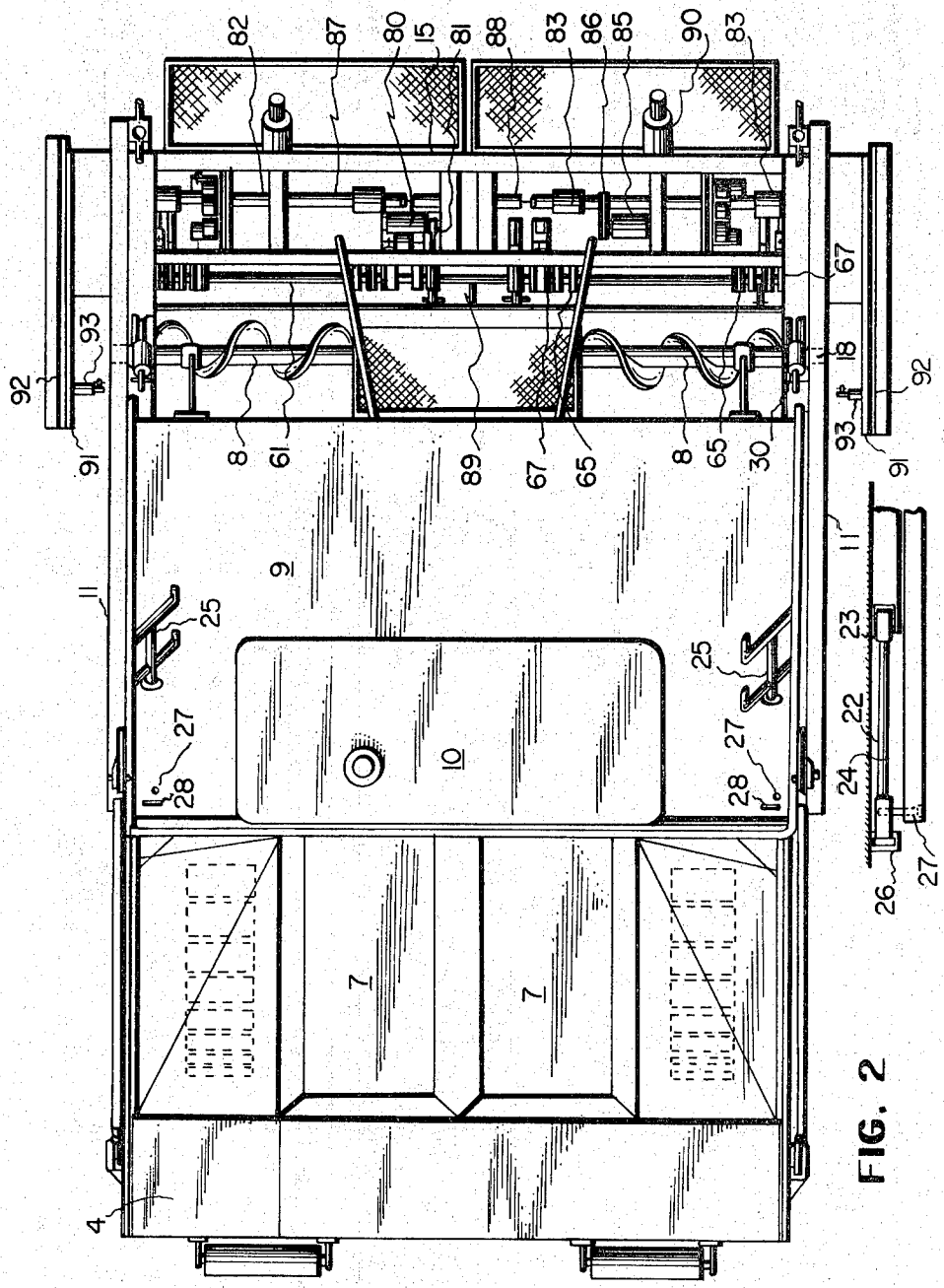

FIG. 3

FIG. 2

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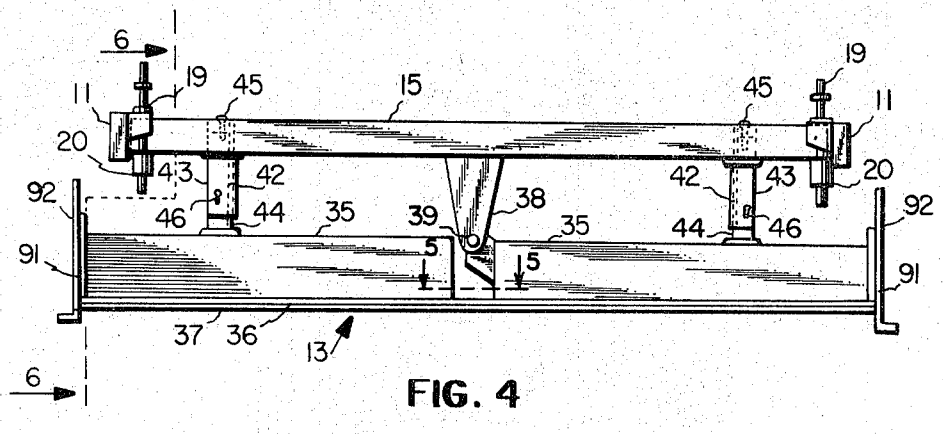

FIG. 4

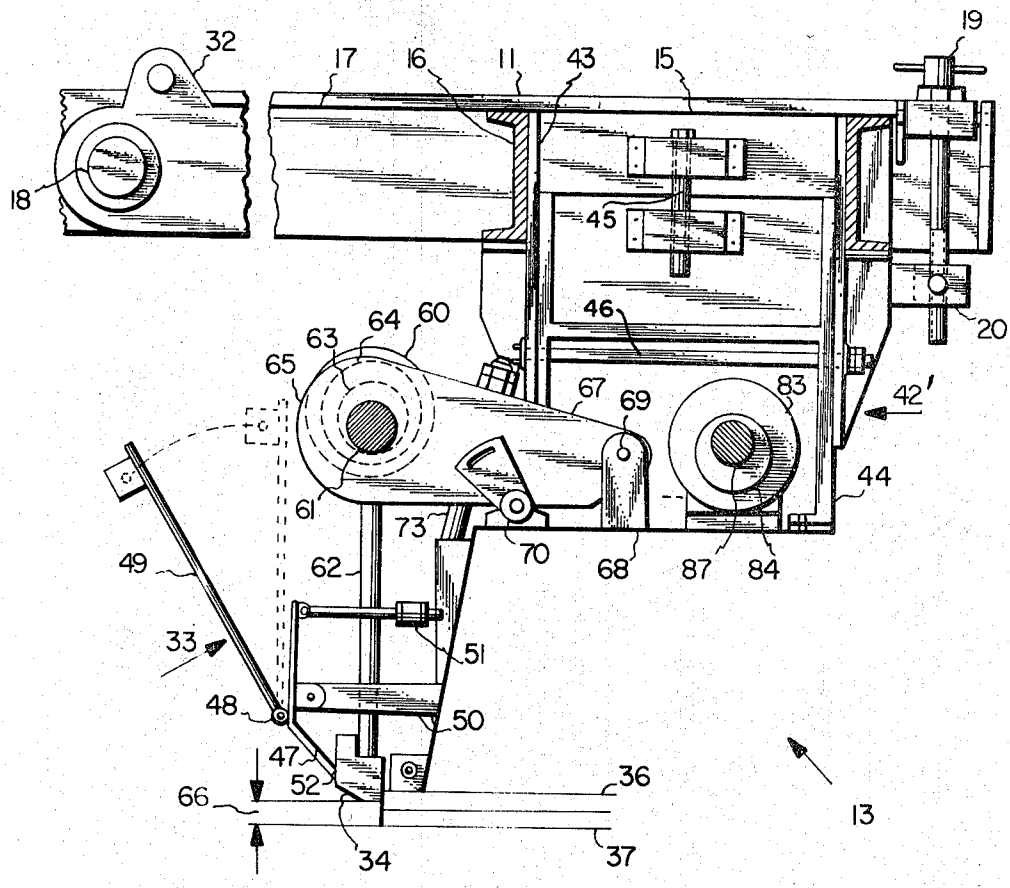

FIG. 6

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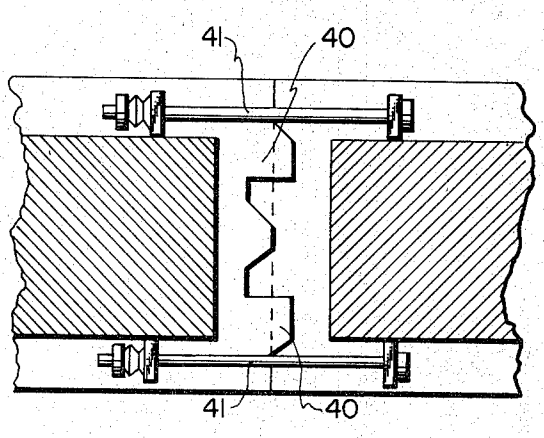

FIG. 5

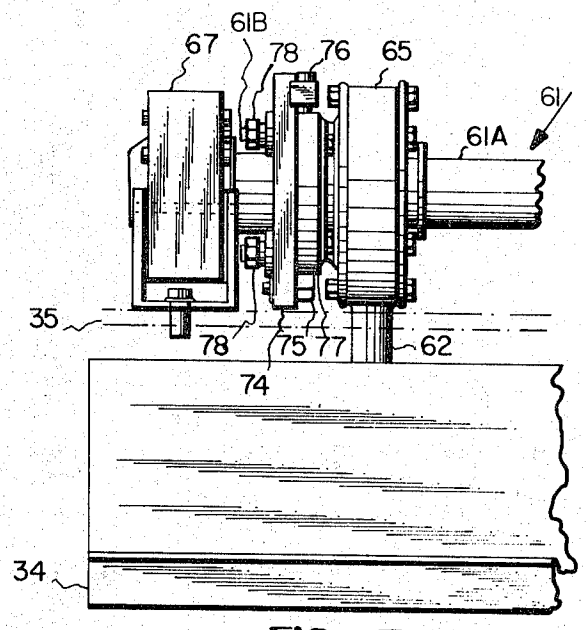

FIG. 7

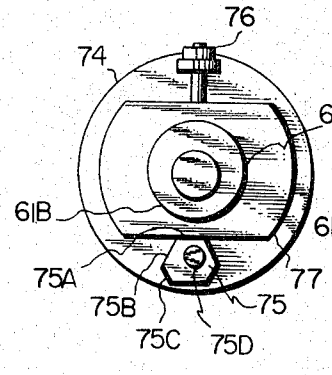

FIG. 8

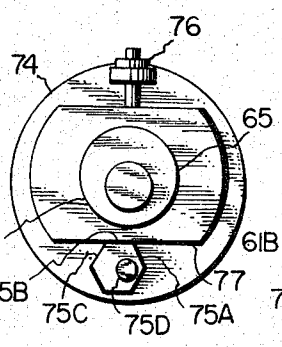

FIG. 9

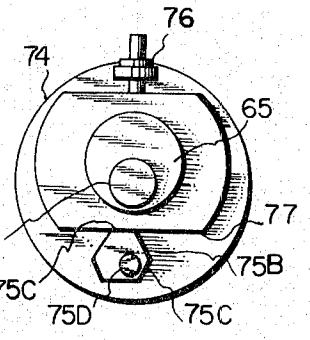

FIG. 10

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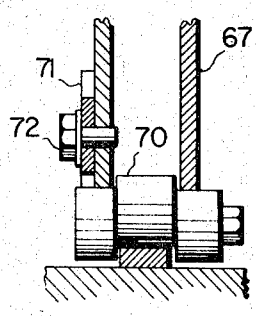

FIG. 12

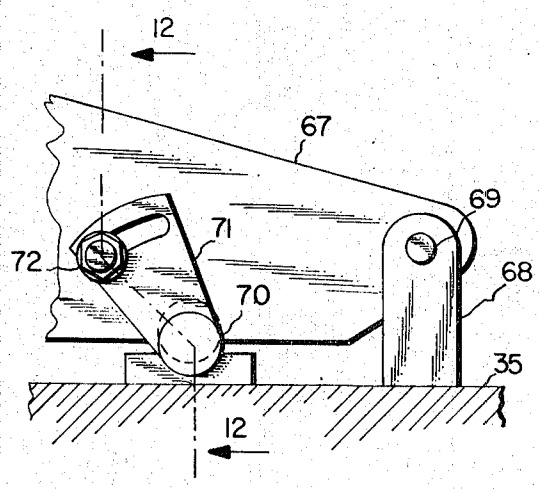

FIG. 11

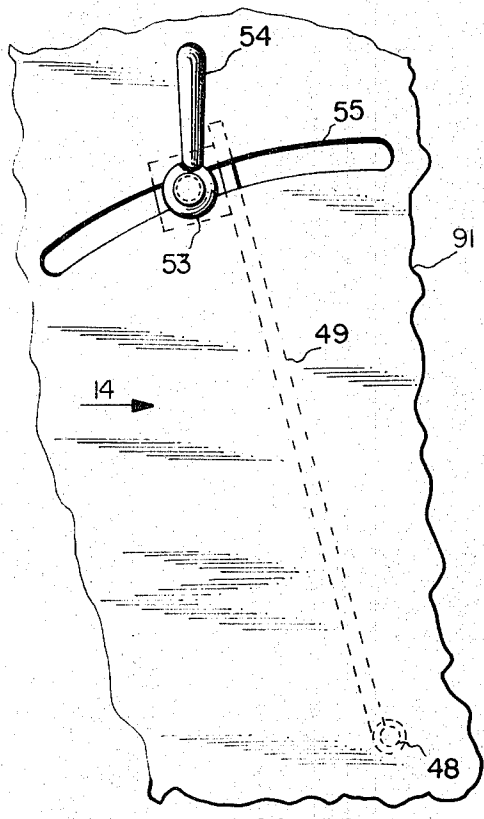

FIG. 13

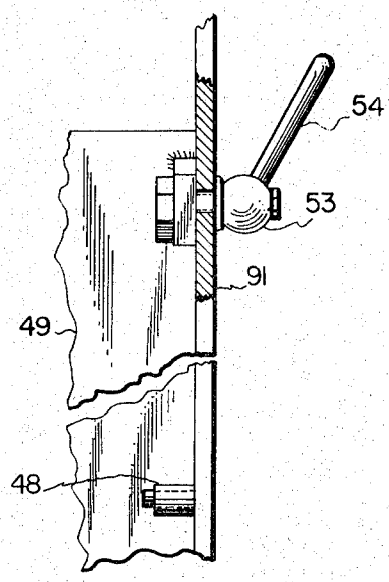

FIG. 14

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SELF-PROPELLING PAVING MACHINE

This application is a continuation-in-part of application No. 508,519 filed Nov. 18, 1965 and now abandoned.

This invention relates to an automotive paving machine for mechanized distribution and compaction of road building materials, such as bituminous mixtures, concrete, coarse gravel, gravel, sand and other materials, as used especially in road and airfield construction.

It is an object of the invention to improve such paving machines with the use of simple construction elements, to such a point that with such a machine, besides a good distribution, also a maximum compaction of the material used in building which can be achieved in a single working step for the prescribed final compacting, which in any case is supposed to be high enough that by a possible subsequent rolling, only an exceedingly small increase in compaction can take place. The evenness of the top side of the building material which is to be achieved by the paving machine is, at the same time, expected to be completely even and, for practical purposes, because of the high achievable final compaction it is no longer to be influenced by a possible subsequent rolling method. Passes with a roller, which were customary hitherto, are to be eliminated thereby.

It is a further object of the invention to make the compacting device of such a paving machine altogether in such a manner that the building material will be given an optimum compaction in one work step by the compacting aggregate. Also, the compacting device is supposed to be suspended in such a manner that it will be easy at any time to adhere to the desired thickness of paving. Besides that, imprints on the surface of the building material caused by the compacting device are to be avoided at all times in the case of a temporary halt of the paving machine. Finally, the compacting device and thus the paving machine itself is expected to be adaptable, in a simple manner to the given paving conditions, to the paving materials and to the roadways that are to be laid.

The above mentioned objects essentially will be achieved by an automotive paving machine for the fully mechanized distribution and compacting of the paving materials, as used especially in road building and airfield construction, with a compacting device suspended by means of a frame of its own on lateral basic units, consisting of a front plate arranged obliquely to the direction of operation of the paving machine and connected with the frame and of a tamper movable up and down perpendicularly and arranged on the frame, whereby the front plate is adjustable in its incline depending on the quality and the flow of the paving material. Thus the height of the impact of the tamper can be adjusted in accordance with the road surface that is to be produced, whereby a device is provided for adjusting the lower dead center of the tamper corresponding to the pertinent adjusted height of the impact or lift. Furthermore a number of vibrators are arranged on the smoothing screed, which, in regard to their frequency, are independent of the impact rhythm of the tamper.

Further details and objects of the invention will be apparent from the following description when considered in connection with the accompanying drawings in which:

FIG. 1 is a side view showing a paving machine according to the invention, presented schematically;

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

FIG. 3 is a top view showing a detail of the paving machine according to Line 3–3 of FIG. 1 in the direction of the arrows;

FIG. 4 is a simplified rear view of the compacting aggregates of the paving machine showing concentric subdivisions and their suspension from a frame mounting swinging between two basic units;

FIG. 5 is a sectional view taken on Line 5–5 of FIG. 4 in the direction of the arrow;

FIG. 6 is a part side view and part sectional view showing the suspension of the compacting devices from the special frame and taken on Line 6–6 of FIG. 4 in the direction of the arrows between two lateral basic units;

FIG. 7 is a side view showing a preferred adjustment of the lift for the tamper on the compacting device;

FIGS. 8, 9 and 10 are side views of FIG. 7 showing the adjustment for various heights of lift on an adjusting device;

FIG. 11 is a side view showing an enlarged partial device for the adjustment of the lower dead center of the tamper corresponding to the pertinent height of lift;

FIG. 12 is a sectional view taken on line 12–12 of FIG. 11 in the direction of the arrows;

FIG. 13 is a side view showing by way of example the adjustment of the front plate of a compacting device as shown in detail in FIG. 6; and

FIG. 14 is a side view, partly in section, taken in the direction of the arrow 14 of FIG. 13.

The automotive paving machine 1, shown in FIGS. 1 and 2, is provided with a crawler or endless traction unit 2. In front, in the direction of travel, there is a material receiving bucket 4, from which two conveying devices 7, driven independently of one another, each move the paving or road building material to a distributor worm 8 or worms 8, which distributes the paving material across the operational width of the device. Above the conveying arrangement 7, a driving motor 10 is provided on the front side of an operator's platform 9. The driving motor 10 serves for the travel drive as well as for the drive of all other operating devices of the paving machine.

Two lateral basic units or bars 11 are provided for the suspension of the rear compacting device 13, which extends behind the two distributor worms 8 and parallel thereto. The compacting device 13 has an upper frame 15, which consists of two parallel U-shaped profiled carriers 16 and two carriers 17 extending at their ends transversely thereto, at the front end of which it has been swingingly or pivotally connected at point 18 with the two basic units 11. At the rear end of each basic unit 11, an adjusting spindle 19 is attached in each case, which is in screw connection at the lower end with an attachment 20 fixed at the underside of the frame 15. frame 15 with a compacting device 13 can be swung around the articulating point 18 by operation of the adjusting spindles 19.

The basic units 11 are connected with the front end of a rod or bar drive 22 by means of a pivoting pin 21 at their front ends, which have been beveled slanting downwards, said pitman being articulated at its rear end 23 to the frame of the paving machine. Every rod 22 is connected with the jack 25 or with a lifting cylinder at point 24 by the operation of which the basic units 11 can be adjusted up and down depending on the desired thickness of the paving surface of the paving material. Every rod 22 has been guided at its front end in a parallel guide 26 attached to the driving unit of the paving machine. Both jacks 25 can be operated from the operator's platform 9. From the front end of each rod 22, a pointer pipe or guide 27 projects only indicated schematically, to beyond the operator's platform 9, where it then is possible to read the present position of the basic units from corresponding scales 28. In case there are hydraulically operated lifting cylinders instead of the jacks 25, it will also be possible to operate them in dependence on a leveling automatic device, in a manner that the compacting device 13, articulated to the basic units 11, will always move at the desired paving height. At the rear end of the boxlike superstructure 29 of the paving machine bridging the conveying devices 7, two hydraulic lifting cylinders 30 have been articulated above the two front ends of the frame 15, the piston rods 31 engaging at frame 15 with lugs or eyes 32. These hydraulic lifting cylinders 30 merely serve for the purpose of lifting the basic units 11 and the compacting device 13 whenever the latter is not to carry out any compacting work. Whenever the compacting device 13 is in operation and compacts the paving material, then these cylinders 30, however, do not function, since, in that case, the compacting device 13 is supported solely by the paving material and is dragged along by means of the basic units 11 corresponding to their setting by the jacks 25 on the paving machine. The compacting device 13, at the same time, is given a certain oblique position by means of the rear adjusting spindles 19 corresponding to the load carrying capacity of the paving material, which essentially depends on its temperature and on its qualities.

The compacting device 13 consists of a front plate 33 adjustable with regard to its angle of inclination, of a tamper 34, arranged immediately behind said plate, and of a smoothing screed 35 which is heated and follows immediately after that end which is made to vibrate by a vibrator strand 82.

As indicated purely diagrammatically in FIGS. 4 and 5, the compacting device 13 has been subdivided centrally for the purpose of adjusting to a desired road surface profile. For the sake of simplicity, only the two smoothing screeds 35 are shown, each of which has a flange strip 36 and a wearing plate 37 thereunder. One of the two smoothing screeds 35 has been suspended swiveling at point 39 from a central suspension 38, firmly connected with the frame 15, while the other smoothing screed 35 is connected by means of an engagement toothing 40, indicated in FIG. 5 merely schematically, in the flange strip 36 with said smoothing screed 35 suspended swinging and has been braced by means of resilient bracing bolts 41 at both longitudinal sides of the smoothing screed 35. Further to the outside, each smoothing screed 35 has been connected each time by means of a bracket 42, which can be adjusted with regard to height, relative to the frame 15.

As can be recognized in FIG. 6, each bracket 42' consists of an upper part 43, which is firmly connected with the two U-profile supports 16 of the frame 15. The upper part 43, just as the lower part 44 firmly connected with the smoothing screed 35, has been developed in the shape of a U-profile. By operation of an adjusting spindle 45, it will be possible to lift or lower the lower part 44 together with the smoothing screed 35 for the purpose of adjusting to a desired paving surface profile. In order that the paving surface profile once adjusted, will not be able to shift by itself during the operation of the paving machine, the upper part 43 and the lower part 44 of every bracket 42 are braced with one another by means of a tie bar 46 guided transversely through both of them.

The compacting device 13 or each half of the compacting device comprise a front plate 33 which is adjustable in its incline corresponding to the quantity and composition of the paving material, said plate consisting of a lower part 47 and an upper part 49 connected therewith swivelably at point 48. The lower part 47 is connected with the front side of the smoothing screed 35 by means of a fixed support 50 and an adjustable support 51, and by adjustment of support 51, it can be kept with its end 52, pointing obliquely downwards, in constant close contact at the front side of the tamper 34. The adjustment of the upper part 49 of the front plate 33 is accomplished, as shown in FIGS. 13 and 14, for example, by means of screw anchors 53 having a handle 54, in longitudinal slits 55 of lateral parts 91 connected with the compacting device 13.

The tamper 34, arranged in front of the smoothing screed 35, has been suspended at both its ends from an eccentric drive 60 which can be adjusted with regard to lift and height. This eccentric drive 60 can be developed in different ways. In one embodiment a driving shaft 61, extending over the length of each smoothing screed 35, can be provided, on which a cam disc 63 is attached within the range of each tamping beam suspension 62. In order to vary the lift of the tamping beam, said cam disc 63 has been surrounded by an adjustable eccentric ring 64, which can be twisted and fixed corresponding to the desired height of lift as compared to the disc 63 fixed on shaft 61. In that case, a roller bearing, not shown, is seated on the eccentric ring 64, on which has been mounted the suspension 62 rotatably with an upper crank pin bearing 65. By the proper development of the eccentric ring 64, it will be possible to adjust the lift of such an eccentric drive, for example, up to 7 or 10 mm. which has been indicated in FIG. 6 at the bottom side of the tamping beam 34 at 66. The distance between the points of the arrows at 66 signifies in this case the maximum height of lift.

So that the tamping beam 34 is moved downwards even after each adjustment of lift to the bottom side of the wearing plate 37 of the smoothing screed 35, each shaft 61 has been mounted in the area of its ends in swivel arms 67, a each of which is seated at its rear end on a swivel pin 69 connected with the smoothing screed 35 by supports 68. The adjustment of each swivel arm 67 takes place by means of an eccentric cam 70, FIGS. 11 and 12, which can be secured in its position by means of a lateral fixing plate 71 and by means of a fixing bolt 72. Thus, it is possible in a simple manner by adjustment of the eccentric cam 70 to set the lower dead center of the movement of the tamping beam in such a manner that the tamping beam 34 will also be moved downwards with its underside at each lift up to the underside of the wearing plate 37 of the smoothing screed 35. In order that the arm 67 cannot escape upwards during the up and down movement of the tamping beam 34, they have been braced additionally in the adjusted position of height, by means of a turnbuckle 73 against the upper side of the smoothing screed 35.

In another preferred embodiment shown in FIGS. 7—10, the adjustment of the lift of the tamping beam 34 can be so formed and divided in such a manner that the shaft 61 in a center part 61*a* and in two end sections 61*b* of which FIG. 7 only shows one. Adjacent to the end parts of the shaft bearings there are provided two swinging arms 67, carrying each end section 61*b* of a flange 74 and each is secured on and is concentric with the particular end section 61*b*. The two stamping suspension means 62 are secured by means of bearings at the middle part 61*a* of the shaft 61 adjacent the flange 77 and they permit generally a radial movement against the end portions 61*b* of the shaft 61 relative to the flange 74. With the flange 74, there is connected a counterflange 77 by means of securing screws 78. The adjustment of the stroke of the tamping means is carried out by radial adjustment of the flanges 77 as to the crank bearing 65 and arranged relative to both stamping suspension means 62. Then the securing screws 78 are loosened on both flanges 74 of the shaft 61. Thus on both of the flanges 74, the screws 76 can now be loosened and turned back. Now, the shaft 61 is turned, so that the lug cam 75 can be reached from above at each flange 74. Both lug cams 75 are then turned by means of a screw spanner, in such a manner that one of the stop faces 75*a*, 75*b*, or 75*c* will be opposite the peripheral surface of the counterflange 77. The stop faces 75*a*, 75*b*, and 75*c* have been displaced in relation to the rotational axis 75*d* of the lug cam, in such a manner that, as a result thereof, a shifting of the lift, for example, of 2, 4 or 7 mm., will be possible. Corresponding code numbers for the lift that is to be adjusted can be attached on the opposing lateral surfaces of the lug cam 75, so that it will be sufficient to turn the latter in such a manner that the corresponding code number can be read from above, in order to adjust a desired lift of the tamping beam. When this has been done, the shaft 61 is turned back again and the contact screws 76 are tightened so firmly and checked, that the counterflange 77 will be enclosed firmly by the lug cam 75 and a contact spring 76. Then the attaching screws 78 can be tightened again.

The drive of the shaft 61, and thus of the tamper beam 34, takes place from a driving engine 80 by means of a V-belt drive 81 infinitely variably with a r.p.m. of up to 1200 r.p.m.

The smoothing screed 35 is placed into vibration by means of a vibrating strand 82. On every smoothing screed 35, at least two vibrators 83 have been attached, which have a revolving eccentric mass 84, and which can be driven by a driving motor 85 by means of a V-belt drive 86 with an infinitely variable r.p.m. of up to 4000 r.p.m. (corresponding to 66.6 Hz). The vibrators 83 of each smoothing screed 35 are connected with one another by a common shaft 87. The shafts 87 of adjoining smoothing screed 35 are connected with one another by means of drive shafts 88 which can be changed as to their length. The shafts 61 are connected in the same manner by drive shafts 89 which can be changed as to their length.

On the rear side of each smoothing screed 35, burner connections 90 have been attached for heating the smoothing screed.

The compacting device 13, developed in accordance with the invention, excells in a particularly favorable manner by the fact that it forms a closed constructional unit within itself

which acts upon the paving material in an even shaking, tamping and vibrating manner. As a result of the fact that both the bearing of the tamper beam and the mounting for the front plate **33**, which can be adjusted with regard to its incline, are connected during operation in a positive manner with the smoothing screed **35**, the drive of the tamping beam and the vibration drive have an effect up to the front plate **33**. Since the front plate can be adjusted additionally in its inclination, this vibration effect can thus be made to act in any desired manner on the paving material for the purpose of its precompacting, even before the front plate. As a result thereof, the paving material is kept in a constant flux, and hollow air spaces in the paving material will be largely vibrated out even before the tamping beam. The tamping beam **34** is beveled at its front edge, such as which likewise contributes to the precompacting of the paving material before it reaches below the horizontal bottom edge of the tamper. Subsequently, the paving material is finally compacted by the heated smoothing screed, swinging at a high frequency and in relation to the tamper, and thus produces its final upper surface. Since the amplitude of vibration of the smoothing screed **35**, which rests with a large surface on the paving material, in comparison to the height of the lift of the tamper, is exceedingly small. Neither the vibration drive of the smoothing screed will have a disadvantageous effect upon the work of the tamper **34**, nor will the smoothing effect of the smoothing screed be influenced disadvantageously by the drive of the tamper **34**. Rather, an optimum final compacting and smoothing of the surface of the paving material will be achieved.

Laterally from the compacting device **13**, limiting plates **91** and **92** have been arranged, of which one as **91**, has been attached firmly to the compacting device and the other **92** has been suspended in pendulumlike fashion. If an excessive congestion of material should occur alongside the limiting plates **91** and **92**, then contact switches **93** attached to the limiting plates become operative, which control the material flow, for example, in the situation of a temporary halt of the conveying arrangements.

It is understood that modifications of the invention are possible without leaving the framework of the invention. Thus, it is possible, for example, to make the adjustment for the upper part **49** of the front plate **33**, in such a manner that the adjustment of the plate can take place from the operator's stand of the paving machine. Besides, it is possible, naturally, to make the compacting device longer, corresponding to the width of the road beds to be made, by means of additional constructional parts laterally, whereby these additional constructional parts are equipped exactly the same way as the compacting devices just described in all their details.

We claim:

1. Automotive road finishing machine for a fully mechanized distribution and compacting of road building material used in road construction with an operating machine arranged on a carrier, comprising a frame, a front plate secured to the frame and arranged transversely to the operating direction of the finishing machine, a tamping beam movable vertically and arranged on the frame, a smoothing screed on the frame, the front plate being angularly adjustable corresponding to the condition and to the flow of material, and the impact height of the tamping beam regulated corresponding to the road cover that is to be constructed, a device for the adjustment of a bottom-dead center of the tamping beam according to the adjusted impact height of the tamping beam, a plurality of vibrators on the smoothing screed which, in their frequency, are independent of the impact rhythm of the tamping beam, and means for vibrating and means for adjusting the amplitude of vibration of said tamping beam.

2. Automotive road finishing machine according to claim **1**, in which two separate motors are provided with the tamping beam and the vibrators on the smoothing screed are driven by the two separate motors of variable speeds so that the frequency of the smoothing screed can be regulated independently of the impact rhythm of the tamping beam.

3. Automotive road finishing machine according to claim **1**, in which the tamping beam is adjustable in height as compared to the smoothing screed.

4. Automotive road finishing machine according to claim **1**, in which the operating devices consisting of the tamping beam, the smoothing screed and the front plate arranged in front of the tamping beam, are subdivided in their center, and in which a common carrying frame is provided so that the operating devices may be suspended from the common carrying frame through a central point of rotation and lateral arrangements for the adjustment in height have been suspended so that for the building of curves during transition from the top profile into the straight away, the pertinent halves of the devices are adjustable independently of the other halves.