SPECIFICATION

Asphalt Laying Machine

The invention relates to an asphalt laying machine having a vibrating smoothing and compacting unit usually designated as the rear body of the machine. Said rear body in use of the machine compacts and smooths the asphalt course laid by the machine, the forward portion of the rear body being provided with means for distributing asphalt material levelled by means of a scraper plate before the asphalt material is compacted and smoothed by the rear body.

The prior art includes rear bodies having a relatively slowly moving tamper which is positioned on the forward portion thereof and which is caused to move in a plane perpendicular to the longitudinal direction of the asphalt course.

The prior art also comprises rear bodies where a smoothing plate is caused to vibrate rapidly in a vertical direction, and finally there are rear bodies comprising a combination of said compacting and smoothing units. The invention relates to the type of rear bodies which have vibration generating means.

It has become common practice to allow for lateral extension of the rear body of asphalt laying machines of the subject type so that the asphalt course laid may have a width of up to 12 m. However, this gives rise to a problem because the known machines only have vibration generating means on the main rear body and not on the connected extensions as the prior art machines are constructed as a rigid unit. Consequently, the vibrations generated in the wide rear body may have nodes such that the smoothing means vibrates to an optimum degree at some points and does not vibrate at all at other points. This results in an undesirable lack of homogeneity in the asphalt course.

The object of the invention is to provide an improved asphalt laying machine permitting a uniformly compacted and smoothed asphalt course.

According to the invention there is provided an asphalt laying machine with a compacting unit comprising a main section with vibration generating means, and comprising one or more additional sections for expanding the working range of the compacting unit, the or each additional section being separately suspended in a vibration isolated manner from a carrier means by associated vibration dampers and being provided with associated vibration generation means, the forward portion of the or each compacting section, seen in relation to the asphalt laying direction of the machine, being connected to the carrier means by vibration dampers arranged to damp both horizontal and vertical vibration of the associated section, and the rear portion of said compacting section being connected to the common carrier means by other vibration dampers permitting substantially undamped horizontal movements in the longitudinal direction of the machine but damping vertical vibration of the associated section.

Preferably the carrier means comprises a main carrier and two side carrier frames which are slidably mounted on the main carrier at opposite sides of the centre of the machine and are each arranged to carry an additional section, the main section and said additional sections being separately connected to the carrier means exclusively by the respective vibration dampers. Hereby it is achieved that the amplitude of the vertical vibrations is biggest in the front edge of a section where the asphalt material is loose, while the amplitude is lower at the rear edge of the section where the asphalt material is compacted. As later described in detail it is also preferred that the front and rear vibration dampers are of the same type, each comprising a shaft secured to the associated section in parallel with the front edge thereof extending through an elastic sleeve in a bushing attached to the common carrier means, the rear sleeves preferably being less yieldable than the front sleeves, and the respective shafts of the rear vibration dampers being connected to the section *via* an arm pivotable around the associated shaft, the arms of the front dampers being rigidly and the arms of the rear dampers pivotably connected to the section.

As each section may vibrate in parallel with the longitudinal direction of the asphalt course, the vibration dampers in the front edge and in the rear edge can thus permit uniform amplitudes in the longitudinal direction of the asphalt course.

A preferred embodiment of the machine uses as vibration generating means eccentric weights comprising two blocks having an eccentric bore for receiving a rotary shaft, each of said blocks having a plurality of holes parallel with the bore for receiving bolts for clamping together the blocks with a desired relative angular positioning around the shaft. This permits an easy adjustment of the vibration amplitude of the section as required in dependency of the thickness of the asphalt course and of the consistency of the asphalt material.

The uniformity of the asphalt course may be further improved by providing a concave scraper plate and by directing the vibrator movement so as to move forward the section in the direction of travel of the machine when the section is near its lowermost, vertical position. Said concave scraper plate in connection with said vibration functions both as a leveller of the asphalt material and as a means setting the asphalt in a rotary motion, which ensures that the asphalt material as it accumulates before the scraper plate is continuously displaced therefrom for incorporation in the laid bed. This results in a uniform temperature of the asphalt material laid, whereby a smoother surface is imparted to the asphalt course.

In a preferred embodiment of the machine the scraper plate is provided with a plurality of inclined guide plates sloping towards the nearest outer side of the machine in a direction away from the front edge of the associated section. Said

guide plates improve further the even distribution of the asphalt material before it is compacted and smoothed.

The invention will be explained more fully in the following description of an exemplary embodiment with reference to the accompanying drawings, in which:

Figure 1 is a side view of an asphalt laying machine,

Figure 2 is a rear, schematic view of the rear body of the asphalt machine,

Figure 3 is a section along the line III—III in Figure 2, of an embodiment of the machine according to the invention, and

Figure 4 shows an embodiment of the vibration generating means.

Figure 1 shows schematically a known asphalt laying machine comprising a vehicle 1 with a powered machine preferably having an engine capable of driving it forwards in the direction of the arrow K and of generating a hydraulic pressure to control the movable parts which will be described later. The machine is steered from control unit 2 mounted forward of an operator's seat 2 and has on its forward portion a platform for receiving asphalt material 3 which by means of a conveyor belt in the machine is passed down to a worm 4 for distribution of asphalt material before a rear body 5 over the entire width thereof, said rear body compacting and smoothing the asphalt material to a finished asphalt course in use of the machine. At each side of the machine the rear body 5 is secured to one end of a respective arm 6 the other end of which is pivotably mounted on the base frame of the machine so that the height of the rear body 5 may be adjusted by means of hydraulic cylinders 7, one associated with each arm 6. In the embodiment shown the rear body 5 is symmetric around the central plane M (Figure 2) of the machine in the direction of travel and comprises on either side of said centre line a main smoothing plate 8 and a side smoothing plate 9, which may be moved, for example hydraulically, laterally of the side boundary of the main smoothing plate 8 for increasing the width of the asphalt course laid.

Figure 2 shows to the left of the central plane M of the machine main and side smoothing plates 8 and 9 respectively, said side smoothing plate 9 being moved somewhat to the left. The main smoothing plate 8 is carried by a rigid frame 10 secured to the arm 6 extending rearwardly in relation to the frame 8 with the purpose of guiding and carrying a rigid frame 11 for the side smoothing plate 9 so as to make this movable in parallel with the main smoothing plate 8 immediately behind it. This is achieved by the attachment to the ends of the frame 11 of one or more smooth shafts 18 adapted to slide in associated bushings at the end of the arm 6. Hydraulic means (not shown) may be used for moving the frame 11 to a desired position which is staggered with respect to the frame 10 between an outer position where the asphalt course laid has a maximum width in relation to the central plane M and an inner position where the width of the asphalt course is determined by the main smoothing plate. The frames 10 and 11 as well as the corresponding frames to the right of the central plane M are rigidly interconnected. The smoothing and compacting unit of the machine is divided into a plurality of sections, so that each frame has associated therewith a separate smoothing and compacting section 12, 13 connected to the associated frame 10 and 11 respectively *via* a plurality of vibration dampers. Figure 2 shows two vibration dampers 14 and 16 for the section of the main smoothing plate and two vibration dampers 15 and 17 for the section of the side smoothing plate. Each section has separate, vibration generating means, and the vibration dampers are employed for preventing the vibrations of the individual sections from interacting and propagating to the other part of the machine *via* the arms 6. The sections are of such a size as to give rise to no nodes therein, so that the asphalt material is effected uniformly by the smooth under side of the whole section. As the vibrations cannot propagate to the other part of the machine the wear on said machine is reduced.

Figure 3 shows a section taken along the line III—III in Figure 2 of a vibration damper comprising a front vibration damper 17A and a rear vibration damper 17B. Figure 3 might just as well show a corresponding section of an arbitrary one of the sections as far as the smoothing and compacting section 13 is concerned, while the overhead frame 11 belongs to one of the lateral extension sections, there being shown two smooth shafts 18, 19 carrying the section 13 and slidable in bushings which are firmly mounted with respect to the frame 10 shown in Figure 2. The bushings will thus preferably not extend beyond the main smoothing plate 8 so that the length of the shafts 18, 19 exceeds that of the frame 11 by a distance corresponding to the length of the bushings.

A smoothing and compacting section like the one shown in Figure 3 has on the forward portion thereof a concave scraper plate 20 and a smooth smoothing and compacting plate 21 in the bottom. The scraper plate 20 and the base plate 21 are braced by means of plates of which the plate 22 is shown, and a profiled plate 23 carrying a vibration generating means 24 comprising rotary, eccentric weights which turn in the direction indicated by the arrow P, whereby a vibrating movement is imparted to the section 13 in a vertical as well as a horizontal direction in Figure 3.

The section 13 is mounted in a vibration damping manner in relation to the frame 11, which is achieved by means of vibration dampers, where all vibration dampers at the front edge are formed like the vibration damper 17A shown in Figure 3, while all the rear vibration dampers are formed like the shown vibration damper 17B. The vibration damper 17A comprises a bushing 25

which is attached to the bracing plate 22 and in which there is provided an elastic sleeve 26 with a bore for a shaft 27 secured at either end to a pair of flanges, of which the flange 28 is shown, on the frame 11. The vibration damper 17B comprises likewise a bushing 29 secured to a flange 30 on the frame 11. Within the bushing 29 there is provided an elastic sleeve 31 with a bore for a shaft 32 whose ends are mounted in the prongs of a fork 34, of which the prong 33 is shown. The fork 34 has a threaded, rotatable pin 35 co-operating with an internal thread in one end of a clamp 36, whose other end is formed as a fork whose prongs, of which the prong 37 is shown, extend on respective sides of the support plate 22 and are pivotably attached thereto by means of a shaft 38. The section 13 is thus suspended as far as horizontal movements in Figure 3 are concerned *via* the elastic sleeves 26 and 31.

The sleeve 26 is made of a more elastic material than that of the sleeve 31, permitting a greater vibration amplitude at the front edge of section 13 than at the rear edge of section 13. As the vibration damper 17B is pivotably connected at 38 to the bracing plate 22 it cannot act to damp horizontal movements in Figure 3 the only damping of horizontal vibrations of the rigid section 13 being by means of the vibration damper 17A, while the vibration arrangement of the dampers to damp vertical movements permits a larger vertical amplitude at the front edge of section 13 than at its rear edge. This is an advantage since the asphalt material is looser at the front edge of section 13 than at the rear edge, and a correct adjustment of the total length of the fork 35 and the clamp 36 gives an optimum even compaction to the asphalt material. The horizontal vibration movement of the base plate 21 provides for a smoothing of the asphalt course, leading to a very smooth surface thereof.

In connection with Figure 4 the vibration generating means 24 will be described in greater detail. These means comprise a shaft 40 extending over the greater part of the length of an associated smoothing and compacting section and rotatably mounted in relation to said section by means of blocks 41, 42 secured to the profiled plate 23, which is also shown in Figure 3. The shaft 40 is rotated *via* a V-belt pulley 45 and a motor (not shown) and has near the blocks 41, 42 uniformly formed, eccentric devices 43, 44. Each of these devices comprises a flange 46 attached to the shaft 40 and a corresponding flange 47. Between said two flanges there are positioned two similar discs 48, 49 with associated bores for the shaft 40, said bores being disposed eccentrically with respect to the centre of gravity of each disc. Each disc 48, 49 has a plurality of through bores for receiving bolts 50, 51 extending through the flanges 47, 48 so that the eccentric discs 48, 49 may be clamped between the flanges 46 and 47 with a desired, relative angular positioning predetermined by the positioning of the through bores in the discs 48, 49. The effective eccentricity of the device 43, 44 may thus be varied, for example in dependency on the properties of the asphalt material employed by removing the bolts 50, 51 and turning the discs 48, 49 with respect to each other until a new set of holes in the discs are aligned with the holes in the flanges 46, 47. Then the discs 48, 49 are clamped together again by means of the bolts 50, 51.

When the shaft rotates in the direction of the arrow P in Figure 3 the whole section 13 will perform a vibrating, rotating movement whose amplitude is determined by the eccentricity of the devices 43, 44 and by the effect of the vibration dampers. As mentioned above, the vibration movement at the front edge of the section 13 is not the same as that at the rear edge of the section, the front edge of the section 13 performing vertical movements whose amplitude is greater than the vertical movements at the rear edge. This advantageous distribution of the vertical mode of movement is further enhanced in that the shaft 40 is positioned so that it is nearer to the vibration damper 17A than to the vibration damper 17B.

The described vibration movement which is obtained by the machine may be utilized to improve further the uniformity of the asphalt course because the mode of movement of the front edge of the section 13 in connection with the concave configuration of the scraper plate 20 causes the asphalt material not only to be conveyed to the outer surface of the section, but also to be inverted so that it is not the same material that accumulates before the scraper plate 20 where it may get cold. Said constant inversion of the asphalt material means that the material compacted under the base plate 21 will have a uniform temperature, permitting a more uniform surface to be imparted to the finished asphalt course. The transport of asphalt material in front of the scraper plate 20 may be further improved by providing the scraper plate with a plurality of inclined guide plates of which two guide plates 52 and 53 are shown in Figure 3. It appears from Figure 3 that the guide plates extend from a point at the bottom of the scraper plate 20 and from there in an inclined upward direction and away from the central line M (Figure 2). Hereby the asphalt material is conveyed so effectively towards the outer sides of the extension sections so as to obviate the necessity of extending the worm conveyor 4 shown in Figure 1 beyond the width of the machine 1.

In addition to the many described advantages, which are obtained by the above described machine, it also provides for a better working environment for the operators, the vibration damping reducing the level of noise. For the operator who stands on a footboard on the rear body 5 itself in order to control the quality of the asphalt course it is a clear advantage that the footboard does not vibrate vigorously as is the case in the prior art machines.

Claims

1. An asphalt laying machine with a compacting unit comprising a main section with vibration generating means, and comprising one or more additional sections for expanding the working range of the compacting unit, the or each additional section being separately suspended in a vibration isolated manner from carrier means by associated vibration dampers and being provided with associated vibration generation means, the forward portion of the or each compacting section, seen in relation to the asphalt laying direction of the machine, being connected to the carrier means by vibration dampers arranged to damp both horizontal and vertical vibration of the associated section, and the rear portion of said compacting section being connected to the common carrier means by other vibration dampers permitting substantially undamped horizontal movements in the longitudinal direction of the machine, but damping vertical vibration of the associated section.

2. A machine according to claim 1, wherein the carrier means comprises a main carrier and two carrier frames which are slidably mounted on the main carrier at opposite sides of the centre of the machine and are each arranged to carry an additional section, the main section and said additional sections being separately connected to the carrier means exclusively by the respective vibration dampers.

3. A machine according to claim 1 or 2, wherein the front and rear vibration dampers are of the same type, each comprising a shaft secured to the associated section in parallel with the front edge thereof extending through an elastic sleeve in a bushing attached to the common carrier means, the rear sleeves preferably being less yieldable than the front sleeves, and the respective shafts of the rear vibration dampers being connected to the section *via* an arm pivotable around the associated shaft, the arms of the front dampers being rigidly and the arms of the rear dampers pivotably connected to the section.

4. A machine according to claim 1, 2 or 3, wherein the front edge of the compacting unit is provided with a scraper plate for asphalt material divided into sections, each of which is secured to an associated compacting section for vibration therewith.

5. A machine according to claim 4, wherein the scraper plate sections are concave, the vibratory movements being so directed as to move each section forward in the direction of travel of the machine when the section is near its lowermost position.

6. A machine according to claim 5, wherein the scraper plate sections have a plurality of inclined guide plates sloping away from the front edge of the associated section and towards the nearest outer side of the machine.

7. An asphalt laying machine constructed and arranged substantially as hereinbefore described with reference to and as illustrated in Figures 3 and 4 of the accompanying drawings.

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