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(54) A track tamping machine

(57) A railway ballast tamping machine has, for each rail, two pairs of tamping tools 8, 9, one pair on each side of the rail. Each pair of tamping tools is mounted on a respective tool support 17, 18. The two tool supports are vertically displaceable independently of one another, on a respective pair of vertical guide columns 20, 21 or 22, 23. The guide columns are mounted in a frame 13 which can be moved transversely of the track. Because the tool pairs on respective sides of each rail can be raised and lowered independently, this arrangement is particularly suitable for tamping regions of the track where there are obstacles, for example at switches, while the use of guide columns on a laterally adjustable frame provides for easy and accurate setting of the tools.

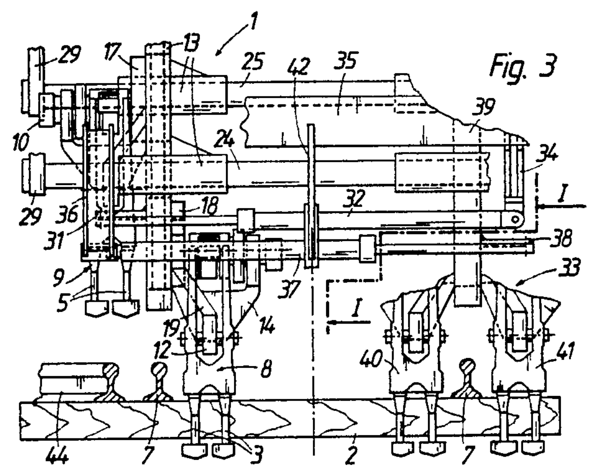

Fig. 3

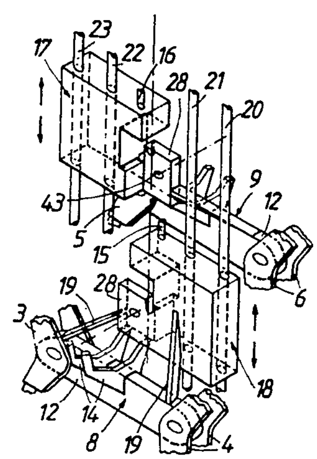

Fig. 4

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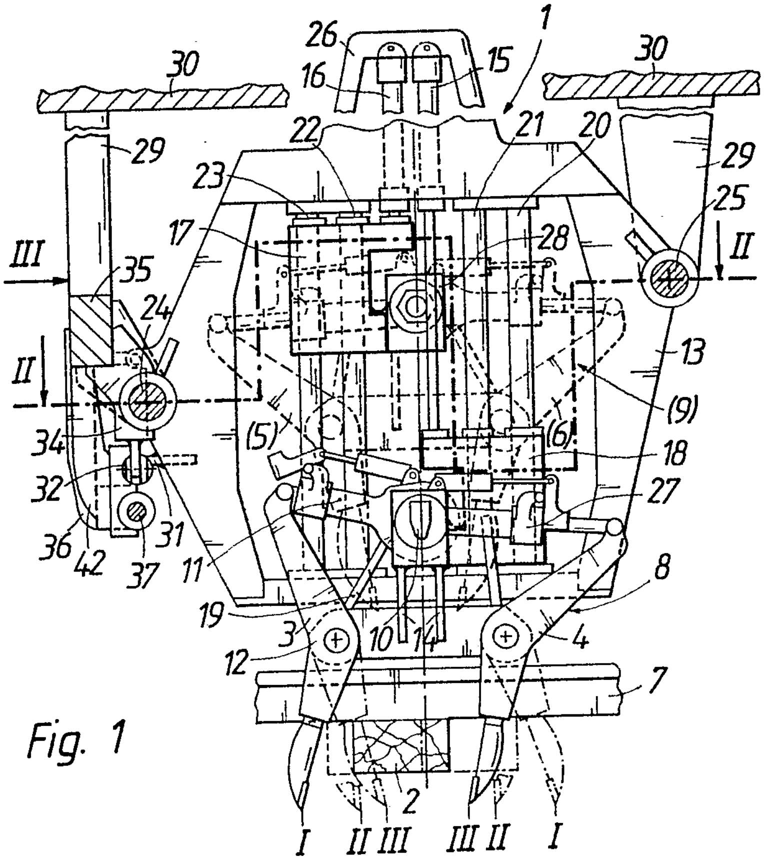
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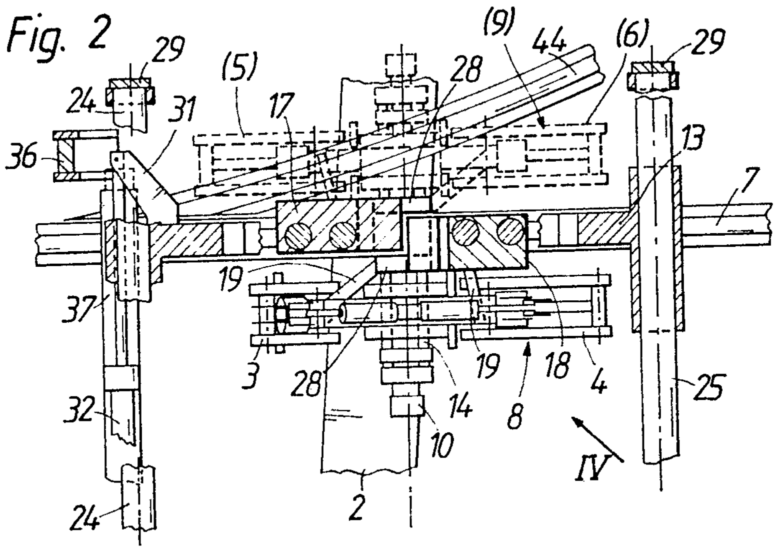
Fig. 1

Fig. 2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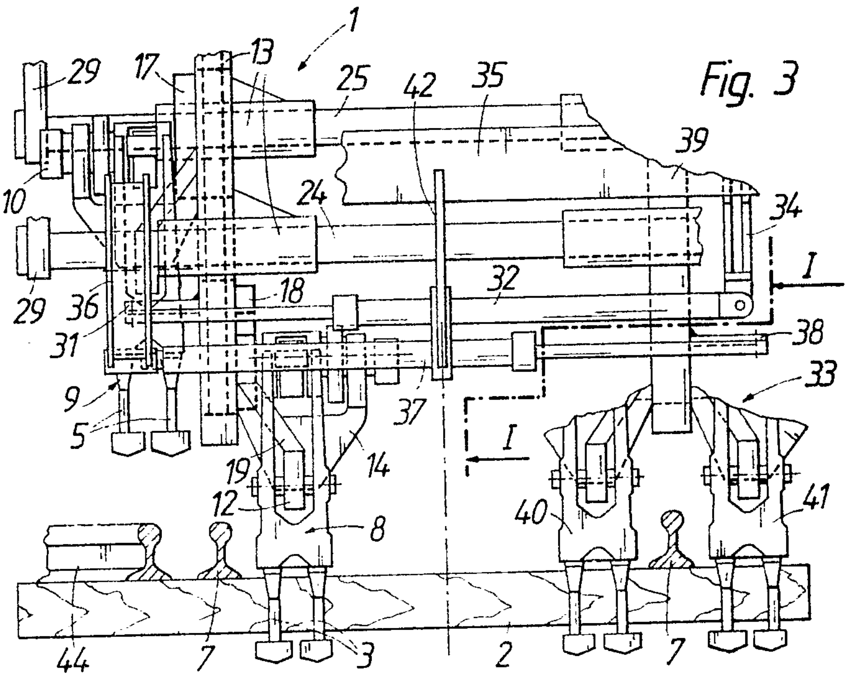
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Fig. 3

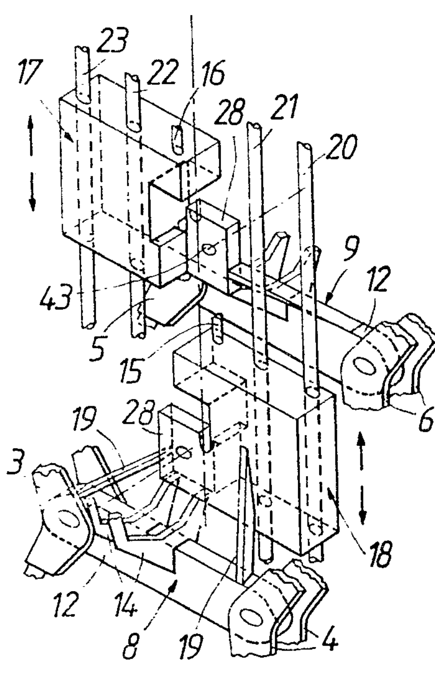
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Fig. 4

SPECIFICATION

A track tamping machine comprising at least one tamping tool unit

This invention relates to a machine for tamping the sleepers of a railway track comprising at least one tamping tool unit which is mounted on a common frame transversely displaceable on guides relative to the machine frame and which is designed for vertical displacement, i.e. for raising and lowering, relative to that common frame along guide posts under the power of a drive, said tamping tool unit comprising tools which are arranged in pairs on a tool support and designed to penetrate into the ballast bed at the sleeper/rail intersection and which are designed for displacement independently to one another under the power of a hydraulic cylinder-and-piston squeezing drives and to be vibrated by a drive. G.B. 2096215A describes a machine for tamping the sleepers of a track comprising at least one tamping tool unit which is mounted on a common frame transversely displaceable on guides relative to the machine frame and which is designed for vertical displacement, i.e. for raising and lowering, relative to that common frame along guide posts under the power of a drive. Each of these tamping units associated with the left-hand and right-hand rail comprises tamping tools which are arranged in pairs on a tool support and designed to penetrate into the ballast bed at the sleeper/rail intersection and which are designed for displacement independently of one another under the power of hydraulic cylinder-and-piston squeezing drives and to be vibrated by a drive. Machines of this construction, particularly with such tamping tool units designed to tamp the track on the so-called asynchronous tamping principle, have proved very successful in use on plain track.

In addition, G.B. 957268 describes a tamping tool unit for a travelling track tamping machine of which the tamping tools are designed to be vibrated in pairs via eccentric arms and to be moved towards one another in pairs under the power of a squeezing drive situated in the region of a pivotal joint. To enable these tamping tools to be vertically adjusted and pivoted in a plane perpendicular to the squeezing direction, the lower part of each tamping tool is designed to be activated by a hydraulic cylinder-and-position assembly. This enables the machine to be used on difficult sections of track particularly at switches.

G.B. 2060035 describes a travelling track tamping machine in which two independent, complete tamping units designed for vertical displacement and for transverse pivoting are provided on both sides of each rail. Each tamping unit comprises only two tamping tools which are mounted on a tamping tool support for penetration on the left and right of a sleeper and which are designed for vibration by a drive and to be moved towards one another by a squeezing drive. Machines of this type equipped with only one pair of tamping tools per rail are relatively complicated in construction and have never been successfully used in practice.

In addition, G.B. 1299476 describes a travelling track tamping machine comprising a cantilever-type frame to which two tamping tool units (per rail) vertically displaceable independently of one another are connected for universal pivoting. These tamping tool units comprise pairs of vibratable tamping tools squeezable towards one another which are each designed to penetrate into the ballast bed to the left or right of a rail, i.e. a total of four tamping tool units each consisting of a pair of tamping tools. The individual tamping tool units provided on the left and right of each rail and each arranged on a vertically displaceable frame are each mounted for vertical displacement along a latterally pivotal guide post under the power of a drive. A number of tamping tool units as large as this, i.e. two units per rail, requires considerable input in terms of construction and control equipment. Accordingly, this known tamping tool unit arrangement is only suitable to a limited extent for tamping switches.

The object of the present invention is to provide a track tamping machine comprising at least one tamping tool unit of the type described at the beginning, particularly for use at switches, which despite its simple construction provides for rapid and effective adaptability to various arrangements of the particular track construction.

According to the invention, this object is achieved in that, in a tamping tool unit of the type described at the beginning, tha pairs of tamping tools designed to penetrate into the ballast bed on the left and right of the associated rail adjacent the sleeper are each mounted on separate tool supports designed for vertical displacement independently of one another under the power of their own displacement drives, each tool support being mounted on two vertical guide posts and the four guide posts being connected to the frame displaceable by a drive along the guides of the machine frame transversely of the longitudinal axis of the machine.

The structurally relatively simple arrangement according to the invention of the pairs of tamping tools—of a tamping tool unit associated with one of the two rails and designed for transverse displacement—on their own tool support enables the two pairs of tamping tools of a unit—transversely displaceable of the longitudinal axis of the machine—to be advantageously raised and lowered independently of one another. With only one of the two tool supports lowered, it is even possible to tamp those sections of track where obstacles, such as for example a switch tongue, do not allow the other pair of tamping tools to penetrate into the ballast bed. Accordingly, the individual tools may be extensively adapted to even the most difficult sections of track for the almost complete tamping thereof. The mounting of each tool support on two guide posts, compared with standard tamping unit constructions comprising only one tool support for two pairs of tamping tools, provides for an equally solid construction capable of withstanding heavy, in particular jolt-like loads. The mounting of all four guide posts on a common frame ensures that, even where only one pair of tamping tools is in use, the other pair of tamping tools situated in the rest position automatically remains centered. Even in the event of transverse displacement of the frame, this provides for particularly rapid adaptation of the constantly changing working conditions prevailing at switches. Since, for working on plain track, it is merely necessary to actuate both vertical displacement drives at the same time or, for difficult switches, one of the two drives, the outlay on control equipment is also relatively low.

In one preferred embodiment of the invention, the four guide posts fixed to the transversely displaceable frame are arranged in a common plane of the frame and symmetrically in relation to the transverse plane extending transversely of the longitudinal plane through the two vibration drives of the tamping tools. This structural solution of a series arrangement of the guide posts provides for a compact construction of the tamping tool unit, the symmetrical arrangement ensuring substantially uniform loading of the transversely displaceable frame.

In another embodiment of the invention, each pair of tamping tools with its associated vibration and squeezing drives is mounted on two vertical support plates which extend transversely of the plane of the frame and which are each connected on that side facing the frame to the corresponding tool support. By virtue of these vertical support plates, the connection of the pairs of tamping tools to the corresponding tool support is able to withstand heavy loads, the vertical arrangement providing for a connection which is particularly stiff in flexure and which is easy to establish.

In another advantageous variant of the invention, the frame with the two tool supports mounted thereon for vertical displacement independently of one another is connected to a hydraulic cylinder-and-piston drive extending transversely of the longitudinal axis of the machine, the cylinder end of the cylinder-and-piston drive preferably being fixed in the region of the opposite tamping tool unit to a transverse spar of the frame of the track tamping machine. The use—thus made possible—of a drive having a particularly long displacement path for the transverse displacement of the tamping tool unit provides for improved centering of the tamping tools laterally of switch tongues or similar obstacles. At the same time, it is possible, particularly at switch crossings, to tamp virtually all the rail/sleeper intersections by utilizing the ability of the two pairs of tamping tools to function independently of one another.

Another advantageous embodiment of the invention is distinguished by the fact that the pairs of tamping tools each connected to a tool support are designed symmetrically in relation to the plane of the frame and are each connected to two hydraulic cylinder-and-piston squeezing drives which preferably comprise at least one hydraulically operable unit for limiting the opening width of the tamping tools to enable those tamping tools to be opened to different extents. This standard construction of a tamping tool unit, in combination with the tool supports mounted on a common frame for vertical displacement independently of one another, provides a further possibility for adaptation of difficult sections of track through different opening widths of the tamping tools. Accordingly, it is possible in particular to tamp even the sleepers situated obliquely in switches using both tamping tool units at the same time.

Finally, in another variant of the invention, each tamping tool unit associated with one rail of the track is designed for independent transverse displacement along guides under the power of its own cylinder-and-piston drive and each pair of tamping tools of both tamping units is mounted on tool supports designed for vertical displacement independently of one another. These two possibilities of displacing the two tamping tool units of a tamping machine independently of one another enable the tamping tool units to be universally used, even for difficult sections of track, the tamping tools being adaptable to the irregular line of the track very largely independently of one another.

A preferred embodiment of the invention is described in detail in the following with reference to the accompanying drawings, wherein:

Figure 1 is a side elevation of a partial section through one of the two tamping units arranged on the frame of a machine according to the invention for tamping the sleepers of a track in the region of the rail/sleeper intersection in the direction of arrow I in Fig. 3. In the interests of clarity, the tamping unit visible on the left of Fig. 3 is shown with the left-hand pair of tamping tools in the raised position and the right-hand pair of tamping tools in the lowered position. In Fig. 1, the left-hand pair and rear, raised pair of tamping tools are shown in chain lines.

Figure 2 is a cross-section on the line II–II in Fig. 1 with a plan view of the lowered pair of tamping tools on the left of Fig. 3.

Figure 3 is a partial front elevation of the two tamping tool units each associated with a rail in the direction of arrow III in Fig. 1.

Figure 4 is a partial, diagrammatic perspective view of the tamping tool unit shown in Fig. 2 looking ahead from the right in the direction of arrow IV.

The tamping tool unit 1 shown in Figs. 1 to 4 consists of four tamping tools 3, 4, 5, 6 which are designed to penetrate into the ballast one the left and right of a sleeper 2 and which form two pairs 8 and 9 of tamping tools arranged on the left and right of a rail 7. In the interests of clarity, the rear pair 9 of tamping tools is shown in chain lines. Each pair 8, 9 of tamping tools together with respective vibration and squeezing drives 10, 11 are mounted via a beam 12 on two vertical support plates 14 extending transversely of the longitudinal plane of a frame 13. The pairs 8, 9 of tamping tools which are designed to penetrate into the ballast on the left and right of the associated rail and to be moved towards one another in pairs by the squeezing drives 11 are each arranged through the vertical support plates 14 on separate tool supports 17, 18 designed for vertical displacement independently of one another uner the powr of two displacement drives 15, 16. The beam 12 is additionally connected to the tool support 17, 18 by two supports 19. Each tool support 17, 18 is mounted on two vertical guide posts 20, 21 and 22, 23, the four guide posts 20–23 of the two tool supports 17, 18 vertically adjustable independently of one another being mounted on the common frame 13 transversely displaceable on horizontal guides 24, 25. At their cylinder ends, the two hydralic displacement drives 15, 16 for the independent vertical displacement of the two tool supports 17, 18 are pivotally connected to a support frame 26 connected to the frame 13, whilst their piston ends are fixed to the upper end of the corresponding tool support 17, 18.

At the cylinder/piston junction, the hydraulic cylinder-and-piston squeezing drives 11, which operate on the "asynchronous" tamping principle, are each connected to a hydraulically operable unit 27 for limiting the opening width of the tamping tools 3–6 to enable the tamping tools 3–6 to open to different extents. This limiting unit 27 consists of a limiting stop designed to be swung up onto the piston rod of the squeezing drive 11, enabling the displacement or squeezing path of the squeezing drive 11 to be varied.

It can be seen from Fig. 2 that the two tool supports 17, 18 are each designed asymmetrically to the guide posts 20–23. Provided at their mutually opposite ends are rectangular and outwardly offset mounting plates 28 which extend beyong the middle line and to which both the two support plates 14 and also a support 19 are fixed. By virtue of the fact that the mounting plates 28 are offset, the two tool supports 17, 18 can be vertically displaced independently of one another without interference, despite the projection of the mounting plates beyond the middle line.

As can be seen in particular from Figs. 2, 3 and 4, the four guide posts 20–23 fixed to the frame 13 are arranged in a common plane of the frame and symmetrically in relation to the transverse plane extending trasversely of the longitudinal plane through both vibration drives 10 of the tamping tools 3–6. At their ends, the two guides 24, 25 extending over the entire width of the track are each connected by a support 29 to a frame 30 of a track tamping machine. For transverse displacement, the frame 13 is connected by a support 31, which is vertically connected to the frame 13, to a hydraulic cylinder-and-piston drive 32 which extends transversely to the longitudinal axis of the machine and of which the cylinder end is fixed in the region of an opposite tamping tool unit 33 (shown in part only) to a transverse spar 35—connected to the lateral support 29—by a depending supporting arm 34. A vertical supporting arm 36 connected at its upper end to the transverse spar 35 is provided in the region of the left-hand tamping tool unit (Figs. 1 and 3), another hydraulic cylinder-and-piston drive 37 variable in length transversely of the plane of the frame being pivotally connected to the lower end of the supporting arm 36. At its piston end, the hydraulic cylinder-and-piston drive 37 is connected by a support 38 to a frame 39 of the opposite tamping tool unit 33. The tamping tool unit 33 is also mounted for the transverse displacement on the two guides 24, 25 and comprises two pairs 40, 41 of tamping tools each connected to its own tool support for independent vertical displacement. A substantially centrally arranged tie rod 42 connected to the machine frame 30 by the transverse spar 35 is provided to prevent buckling of the two relatively long cylinder-and-piston drives 32, 37 for the transverse displacement of the two tamping tool units 1, 33.

The construction of the two tool supports 17, 18 each mounted for vertical displacement on two guide posts 20, 21 and 22, 23 is clearly apparent from Fig. 4 in which the two pairs 8, 9 of tamping tools fixed to the tool supports are shown in part only in the interests of clarity. The connection to the tool supports 17, 18 is established, on the one hand, by the two vertical support plates 14 and two supports 19 and, on the other hand, by the eccentric shaft of the vibration drive which is mounted in a bore 43 of the mounting plate 28 and which is shown merely as a dash-dot line. The opposite, free end of the vibration drive is also mounted on the two support plates 14. The two support plates 14 and a support 19 are connected to the outwardly offset mounting plate 28. The other support 19 also connects the beam 12 carrying the tamping tools 3, 4 and 5, 6 of the tool supports 17, 18.

It can clearly be seen from the illustrated position of the two pairs 8, 9 of tamping tools belonging to the left-hand tamping tool unit 1 (in Fig. 3) that, even in the presence of a switch obstacle in the form of a branch track 44, the sleeper bearing surface can be at least partly tamped by lowering only that pair 8 of tamping tools facing the obstacle. To that end, only that displacement drive 15 associated with this pair 8 of tamping tools is activated (after exact centering by corresponding transverse displacement of the unit 1 under the power of the cylinder-and-piston drive 32), as a result of which the corresponding tool support 18 together with the pair 8 of tamping tools fixed thereto is lowered and the tamping tines moved towards one another by activation of the two squeezing drives 11. In addition to the adaptation to difficult sections of track which is made possible by the transverse displacement of the unit 1 and by the independent vertical displacement of the pairs 8, 9 of tamping tools, the use of the limiting units 27 provides for further adaptation, particularly to the sleepers positioned obliquely at switches. As shown in Fig. 1, the ballast around the sleeper 2 may be tamped to maximal effect by fully opening the left-hand tamping tool 3 into a position I whilst the right-hand tamping tool 4 is moved from an intermediate position II into an end position III. Because tamping is carried out on the "asynchronous" principle, the ballast is subjected (irrespective of any limitation in the squeezing movement of one tamping tool caused, for example, by an obstacle or by the sleeper to be tamped) to the full tamping pressure by the opposite tamping tool. II denotes the opening width reachable by the limiting unit 27 and I the maximum opening width. As can be seen, it is possible by opening the tamping tools 3, 4 to different widths to tamp any sleeper situated between the left-hand end position shown in chain lines and the right-hand position shown in dash-dot lines. The opposite tamping tool unit 33 may also be analogously controlled at the same time.

CLAIMS

1. A machine for tamping the sleepers of a railway track comprising at least one tamping tool unit which is mounted on a common frame transversely displaceable on guides relative to the machine frame and which is designed for vertical displacement, i,e. for raising and lowering, relative to that common frame along guide posts under the power of a drive, said tamping tool unit comprising tamping tools which are arranged in pairs on a tool support and designed to penetrate into the ballast bed at the sleeper/rail intersection and which are designed for displacement independently of one another under the power of hydraulic cylinder-and-piston squeezing drives and to be vibrated by a drive, characterized in that the pairs of tamping tools designed to penetrate into the ballast on the left and right of the associated rail adjacent the sleeper are each mounted on separate tool supports designed for vertical displacement independently of one another under the power of their own displacement drives, each tool support being mounted on two vertical guide posts and the four guide posts being connected to the frame displaceable by a drive along the guides of the machine frame transversely of the longitudinal axis of the machine.

2. A machine as claimed in Claim 1, characterized in that the four guide posts fixed to the transversely displaceable frame are arranged in a common plane of the frame and symmetrically in relation to the transverse plane extending transversely of the longitudinal plane through the two vibration drives of the tamping tools.

3. A machine as claimed in Claim 1 or 2, characterized in that each pair of tamping tools with its associated vibration and squeezing drives is mounted on two vertical support plates which extend transversely of the plane of the frame and which are each connected on that side facing the frame to the corresponding tool support.

4. A machine as claimed in Claim 1, 2 or 3, characterized in that the frame with the two tool supports mounted thereon for vertical displacement independently of one another is connected to a hydraulic cylinder-and-piston drive extending transversely of the longitudinal axis of the machine, the cylinder and of the cylinder-and-piston drive perferably being fixed in the region of the opposite tamping tool unit to a transverse spar of the frame of the track tamping machine.

5. A machine as claimed in any of Claims 1 to 4, characterized in that the pairs of tamping tools each connected to a tool support are designed symmetrically in relation to the plane of the frame and are each connected to two hydraulic cylinder-and-piston aqueezing drives which preferably comprise at least one, hydraulically operable unit for limiting the opening width of the tamping tools to enable those tamping tools to be opened to different extents.

6. A machine as claimed in any of Claims 1 to 5, characterized in that each tamping tool unit associated with one rail of the track is designed for independent transverse displacement along guides under the power of its own cylinder-and-piston drive and each pair of tamping tools of both tamping units is

mounted on tool supports designed for vertical displacement independently of one another.

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