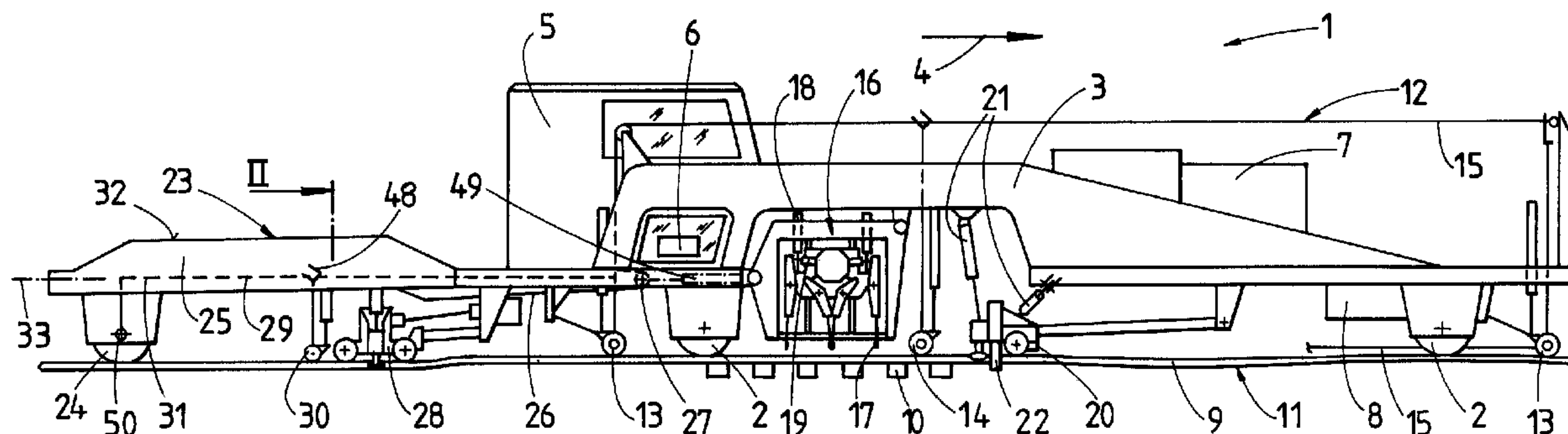




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 (72) Inventeur/Inventor:  
 THEURER, JOSEF, AT  
 (73) Propriétaire/Owner:  
 FRANZ PLASSER BAHNBAUMASCHINEN-  
 INDUSTRIEGESELLSCHAFT M.B.H., AT  
 (74) Agent: RICHES, MCKENZIE & HERBERT LLP

(54) Titre : METHODE ET MACHINE POUR COMPACTER ET STABILISER LE BALLAST D'UNE VOIE FERREE  
 (54) Title: METHOD AND A MACHINE FOR TAMPING AND STABILIZING A TRACK



(57) Abrégé/Abstract:

In a method for tamping and stabilizing a track, in parallel with the continuously recurring tamping sequence: - tamping operation - advance -, in a further, continuously recurring stabilizing sequence consisting of a stabilizing operation and an unloading operation, the track is in each case progressively lowered into the final target position. In the stabilizing operation the load is automatically increased to the lowering value and in the subsequent unloading operation is reduced to an unloading value.

## ABSTRACT

In a method for tamping and stabilizing a track, in parallel with the continuously recurring tamping sequence: - tamping operation - advance -, in a further, continuously recurring stabilizing sequence consisting of a stabilizing operation and an unloading operation, the track is in each case progressively lowered into the final target position. In the stabilizing operation the load is automatically increased to the lowering value and in the subsequent unloading operation is reduced to an unloading value.

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ORIGINAL TEXT

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The invention relates to a method for tamping and stabilizing a track in which the track is lifted into a temporary target position and is tamped progressively, while following this in the working direction the track is set vibrating horizontally and at right angles to the longitudinal direction of the track and is loaded with a vertical load, forming a lowering value, and is thus lowered into a final target position, and also a machine for implementing the method.

A method of this kind, known through US 5 172 635, combines the correction of track geometry errors, which can be achieved within a tamping operation, with subsequent spatial consolidation of the ballast bed by the application of a vertical load and of horizontal track vibrations. In this method the required sleeper bases are created, the inhomogeneity caused by the penetration of tamping tines in the sleeper crib is eliminated, the sleeper end is consolidated and the track is lowered specifically into the target position. This enables the initial settlements of a track which are unavoidable after tamping and the dynamic forces resulting therefrom to be avoided.

The specific lowering of the track known as track stabilization is performed during the continuous forward movement of an appropriate stabilization unit, the load remaining constant to produce a constant lowering value for the track. The tamping of the track is performed in parallel with the track stabilization and immediately preceding it in the working direction within a common machine unit, the track tamping being performed progressively in the region of each

sleeper - during the relative displacement of a tamping unit with respect to the machine unit which is moved forward continuously.

Other machine units for performing stabilization of a track combined with tamping which advance progressively during operational use are known through the following patent specifications: US 4 046 079, US 4 046 078, GB 2 094 379, US 4 430 946.

The object of the present invention is now to provide a method of the type previously defined with which, with a relatively low personnel and machinery requirement, it is possible to achieve a satisfactory combination with respect to the work result of tamping, attainable by advancing progressively, with spacial consolidation of the ballast bed to eliminate initial settlements of the track.

This object is achieved with a method of the type described in the introduction in that in parallel with the continuously recurring tamping sequence composed of the tamping operation and the advancing movement, in a further, continuously recurring stabilizing sequence consisting of a stabilizing operation and an unloading operation the track is in each case progressively lowered into the final target position, the load being automatically increased in the stabilizing operation to the lowering value and reduced in the subsequent unloading operation to an unloading value.

As is generally known in specialist circles and also mentioned in an article in the journal "Railway Track & Structures", March 1984, pages 48 to 52 (see particularly page 48, column 1, lines 39,40 or column 3, lines 7 - 9), the stabilization of a track which is successful in practice is performed with the permanent action thereon of the stabilization unit in conjunction with continuous advancing of the machine. Track stabilizers of this kind have already

proved extremely successful in operation worldwide for more than a decade. As is also mentioned on page 52 of the aforementioned article, column 2, the track stabilizer is particularly suitable, because of its high working efficiency in conjunction with the continuous advancing of the machine, for combined operational use with a high output tamping machine which can similarly be advanced continuously.

According to the patent literature listed in the fourth paragraph of the description's introduction, combining track stabilization also with a tamping machine which advances progressively during operational use, with simplification of the machinery and personnel required, has long been desired. However, it has hitherto been impossible to put any of these known suggestions into practice.

In accordance with the steps of the method according to the invention, the progressive tamping operation is now for the first time combined with a stabilizing operation similarly taking place progressively in parallel therewith. Only by this application of two different loads (lowering- and unloading value) alternately during the stabilization sequence, totally departing from the procedure previously practised, is optimum coordination of the stabilizing operation with the tamping operation taking place progressively immediately beforehand ensured. More particularly, it is thereby possible to eliminate variable stabilization action on the track caused by the machine's alternating advance and thus the variable lowering thereof. Although in comparison with the known continuous mode of operation a loss of output has to be accepted, the method according to the invention is particularly suitable for simplified geometry correction of shorter track sections, with a reduction in the machinery and personnel required.

Further advantageous developments of the invention emerge from the drawing.

The invention is described in more detail in the following with the aid of an exemplary embodiment shown in the drawing, in which

Fig. 1 shows a side view of a track tamping and stabilizing machine comprising a tamping and a stabilization unit,

Fig. 2 shows an enlarged partial cross-section along the sectional line II in Fig. 1,

Fig. 3 to 6 show schematically greatly simplified representations of the tamping and stabilization unit to explain the method according to the invention, and

Fig. 7 to 9 show diagrams depicting the individual operations for the tamping and stabilizing sequences.

A track tamping and stabilizing machine 1 shown in Fig. 1 has a machine frame 3 supported on on-track undercarriages 2, with which there is associated, at the rear end thereof with respect to the working direction (arrow 4), a driver's and operator's cab 5 comprising a central control unit 6. An energy unit 7 serves to supply the various drives as well as a motive drive 8. In order to determine geometry errors of a track 11 composed of rails 9 and sleepers 10 a first reference system 12 is provided. This is essentially composed of two measuring trolleys 13 arranged at each end of the machine frame 3 with respect to the longitudinal direction of the machine, a middle measuring trolley 14 and tensioned chords 15.

Provided immediately preceding the rear on-track undercarriage 2 is a tamping unit 16 for simultaneously tamping two adjacent sleepers 10. This tamping unit 16 comprising tamping tines 17 which may be set vibrating is designed so as to be vertically adjustable by means of drives

18. In order to consolidate the ballast beneath the sleepers 10 to be tamped, the tamping tines 17 may be squeezed together in the known way in the longitudinal direction of the machine by means of squeeze drives 19. Arranged immediately preceding the middle measuring trolley 14 is a track lifting-lining unit 20 designed to ride on the track 11, which is connected to the machine frame 3 so as to be vertically and laterally adjustable by means of drives 21. Vertically and laterally adjustable lifting tools 22 are provided for gripping the track 11.

Provided immediately following the machine 1 is a stabilizer vehicle 23 with a vehicle frame 25 supported on an on-track undercarriage 24. A front frame end 26 of this frame is connected by a universal joint 27 to the machine frame 3 of the track tamping and stabilizing machine 1. Approximately centrally between the joint 27 and the on-track undercarriage 24 a stabilization unit 28 is connected to the vehicle frame 25. A second reference system 29 is provided for determining the vertical track geometry errors. This has a vertically adjustable measuring trolley 30 designed to ride on the track immediately following the stabilization unit 28. The front end of a tightly tensioned chord 31 extending in the longitudinal direction of the machine is mounted on the rear measuring trolley 13 of the first reference system 12 and the rear end thereof on an axle box 50 of the on-track undercarriage 24. Drives of the stabilization unit 28 yet to be described in detail in Fig. 2 are provided with energy by the energy unit 7.

A top boundary line 32 of the stabilizer vehicle 23 is created by the vehicle frame 25 which is located in a horizontal plane 33 - running through the joint 27 and indicated by a dot and dash line. This ensures that an operator in the driver's and operator's cab 5 is also able to drive the track tamping and stabilizing machine 1 without difficulty in the opposite direction to the working direction

(for transfer travel).

As is evident in Fig. 2, the stabilization unit 28 rests on the rails 9 of the track 11 by means of flanged rollers 34 (four altogether). Each two flanged rollers 34 positioned opposite one another in the transverse direction of the machine are connected to a hydraulic spreading drive 35 to eliminate the gauge play. Two vibrators 38, designed as eccentric drives, are mounted in an auxiliary housing 37 connected to drives 36 whose upper ends are pivotally connected to the vehicle frame 25. These vibrators are designed to generate vibrations (indicated by arrow 45) extending in the transverse direction of the machine and parallel to the axes of rotation 39 of the flanged rollers 34. Between the two flanged rollers 34 respectively associated with the same rail 9 a so-called roller gripper 40 is mounted on the auxiliary housing 37 so as to pivot about an axis 41 extending in the longitudinal direction of the machine. This pivoting movement is effected by means of a hydraulic drive 42. Provided at the lower end of each roller gripper 40 is a roller disc 44 which is rotatable about an axis 43. The maximum load acting on the track 11 under the operation of the drives 36 and producing the lowering thereof into the final target position is shown by an arrow 46. An unloading value or minimum loading pressure which, compared with the maximum load, is reduced in a range of 20 to 100 percent is indicated by the shorter arrow 47. The load acting on the track 11 in the vertical direction is infinitely adjustable up to about 300 kilonewtons, by controlling the pressure acting on the drives 36 by means of a proportional pressure valve. By maximum load is meant the force with which the track, set vibrating transversely, is lowered into the target position with consolidation of the ballast bed. The magnitude of the maximum load selected for this depends on various parameters, such as, for example, track lowering depth, duration of action, type of machine etc.

In an alternative design variant the joint 27 may also be mounted on the machine frame 3 so as to be displaceable in the plane 33 and in the longitudinal direction of the machine. The displacement is effected by means of a longitudinal displacement drive 49 (indicated by dot and dash lines in Fig. 1). Thus, for example, even if the duration of the tamping sequence is particularly variable, the duration of the stabilization sequence can be largely kept constant.

The central control unit 6 shown in Fig. 1 is designed for automatic and simultaneous operation by drives 18,38, associated with the tamping unit 16 and the stabilization unit 28, for increasing the load, in parallel with lowering the tamping unit 16, from a low unloading value to the maximum load. In an alternative embodiment, described in more detail with reference to Fig. 9, the individual tamping and stabilizing sequences may, however, also be staggered over time, i.e. they may be of different durations.

The method according to the invention will now be described in more detail below with the aid of Fig. 3 to 6 in which the tamping and the stabilization unit 16,28 and also the track 11 are shown schematically. The track 11 is raised in the region of the tamping unit 16 by the value  $x$  into a temporary target position (see small arrow in Fig. 3), is moved into the correct lateral position and tamped. The machine's advance is interrupted for this purpose. In parallel with the tamping operation, with the aid of the stabilization unit 28 the track 11 which has already been tamped is lowered in a stabilizing operation by the value  $y$ , also called the desired settlement value, into the final target position. For this, a maximum load, reference numeral 46, is applied (with operation of the drives 36) to the stabilization unit 28 and thus to the track 11. A level feeler 48 (Fig. 1) connected to the measuring trolley 30 records when the desired track lowering is reached and thereupon automatically reduces the maximum load 46, producing

an unloading value 47 or minimum loading pressure (Fig. 4). This is reduced by at least 20 percent in comparison with the maximum load 46 and serves to maintain secure, frictionally locked running of the stabilization unit 28 on the track 11. The ideal size of the reduction is dependent on various parameters such as, for example, the absolute magnitude of the maximum load 46, duration of the stabilizing and/or unloading operation, vibration frequency, etc.

As soon as the tamping operation is completed, the tamping unit 16 is raised and the tamping and stabilization unit 16,28 are jointly moved forward immediately afterwards, with the corresponding advance of the machine 1 (Fig. 4). During this advance the stabilization unit 28 is merely acted upon with the unloading value 47 in a part of the sequence referred to as the unloading operation, and as a result of the pressure of the roller discs 44 against the rails 9 remains as before in frictional engagement therewith. The vibration frequency may be maintained unchanged or may also be reduced if desired.

After arrival at the next tamping site (see dot and dash lines of the tamping unit 16 in Fig. 4) there is an interruption in the machine's advance. Next, with simultaneous operation of the drives 18 and 36 to initiate the tamping and stabilizing operations respectively, the tamping unit 16 is lowered and the loading of the stabilization unit 28 is increased to the maximum value 46 (see Fig. 5). After the desired track lowering in the region of the stabilization unit 28 (Fig. 6) and the completion of the tamping in the region of the tamping unit 16 have been reached, a new cycle begins in the manner already described, by the two units 16,28 being moved forwards together to the next site of use with the tamping unit 16 raised and the maximum load 46 reduced.

The individual operations of the method according to the invention relating both to the tamping sequence and to the

stabilizing sequence are shown in Fig. 7 to 9 in the form of diagrams. In these, "a" denotes the tamping operation and "b" the advance. The capital letters "A" and "B" denote respectively the stabilizing and the unloading operation forming the stabilizing sequence. "t" stands for the time axis and thus for the duration of the individual operations of the aforementioned sequences.

It is clear above all from the diagram in Fig. 7 that the tamping operation a, on the one hand, and the stabilizing operation A initiating the track stabilization, on the other hand, are each initiated at the same time. The maximum load on the stabilization unit is reduced in the unloading operation B in parallel with the advance b immediately following the tamping operation a. Thus both the individual sequences and the parts of the sequences run synchronously.

It is evident from the diagram shown in Fig. 8 that the tamping and stabilizing sequences can also be staggered by half a sequence. In this the reduction of the load to the unloading value (unloading operation B) takes place in parallel with the tamping operation a. The lowering of the track (stabilizing operation A) takes place in parallel with the advance of the machine 1. In these versions shown in Fig. 7 and 8 the duration of the stabilizing operation can be adapted to match the duration of the tamping operation provided that the magnitude of the maximum load is reduced, for instance, in order to prolong the stabilizing operation.

According to Fig. 9, the stabilizing operation A of the stabilizing sequence, initiated with the increasing of the load, is of a shorter duration than the tamping operation a begun in parallel therewith. This means that the unloading operation B in part (the lesser part) begins actually during the tamping operation and continues until the tamping unit is lowered in order to initiate the next tamping operation. In this case a slow forward movement of the vehicle frame 25 can

be initiated by operation of the longitudinal displacement drive 49 immediately after the completion of the stabilizing operation A.

Common to all three combinations of tamping and stabilizing sequences, shown by way of example in Fig. 7 to 9, is that the stabilizing sequence is in each case composed of a stabilizing operation for performing the track stabilization and an unloading operation immediately following it.

## Claims

1. A method for tamping and stabilizing a track in which the track is raised into a temporary target position and tamped progressively, while following this in the working direction the track is set vibrating horizontally and at right angles to the longitudinal direction of the track and is loaded with a vertical load, forming a lowering value, and is thus lowered into a final target position, wherein in parallel with the continuously recurring tamping sequence composed of the tamping operation and the advancing movement, in a further continuously recurring stabilizing sequence consisting of a stabilizing operation and an unloading operation, the track is in each case progressively lowered into the final target position, the load being automatically increased in the stabilizing operation to the lowering value and reduced in the subsequent unloading operation to an unloading value.
2. A method according to claim 1, wherein in the unloading operation the load is reduced by 20 to 100 percent of the maximum load to obtain the unloading value.
3. A method according to claim 1 or 2, wherein the vertical load is increased to the lowering value at the same time as the tamping operation of the tamping sequence is initiated.
4. A method according to claim 1, 2 or 3, wherein the distance between the tamping and the stabilizing operation is kept constant.
5. A method according to any one of claims 1 to 4, wherein during the unloading operation, the vertical load is reduced by at least 50 percent of the lowering value to form the unloading value operative during the advance to the next

tamping operation.

6. A method according to any one of claims 1 to 5, wherein in parallel with the formation of the unloading value, the vibration frequency of the track is also reduced.

7. A method according to any one of claims 1 to 6, wherein the changeover from the higher lowering value to the unloading value is effected before the final target position is reached, the rest of the track lowering occurring as a result of the actions upon it in the course of the following unloading operation.

8. A track tamping and stabilizing machine (1), comprising a machine frame (3) supported on on-track undercarriages (2), with which a vertically adjustable tamping unit (16) for a progressive working advance from sleeper (10) to sleeper (10), a vertically adjustable track lifting-lining unit (20) and a reference system (12) with a measuring trolley (13,14) designed to ride on a track (11) are associated, and a stabilizer vehicle (23) coupled so as to follow in the working direction, with which a stabilization unit (28) and an on-track undercarriage (24) are associated, for the implementation of the method according to claim 1, wherein the front frame end (26) of the stabilizer vehicle (23) is connected to the machine frame (3) of the machine (1) by means of a universal joint (27), and the said stabilizer vehicle has its own reference system (29) for the vertical track position.

9. A machine according to claim 8, wherein a top boundary line (32) of the stabilizer vehicle (23) is created by a vehicle frame (25) located in a horizontal plane (33) running through the joint (27).

10. A machine according to claim 9, wherein a driver's and operator's cab (5) is associated with the rear

end of the machine frame (3) situated in the region of the joint (27).

11. A machine according to claim 8, wherein the rear measuring trolley (13), in the working direction, of the reference system (12) associated with the tamping unit (16) is designed as the front measuring trolley (13) of the reference system (29) associated with the stabilization unit (28).

12. A machine according to any one of claims 8 to 11, wherein a central control unit (6) is provided for automatic and simultaneous operation of drives (18,36) associated with the tamping unit (16) and the stabilization unit (28) respectively, for vertically adjusting the respective unit (16,28).

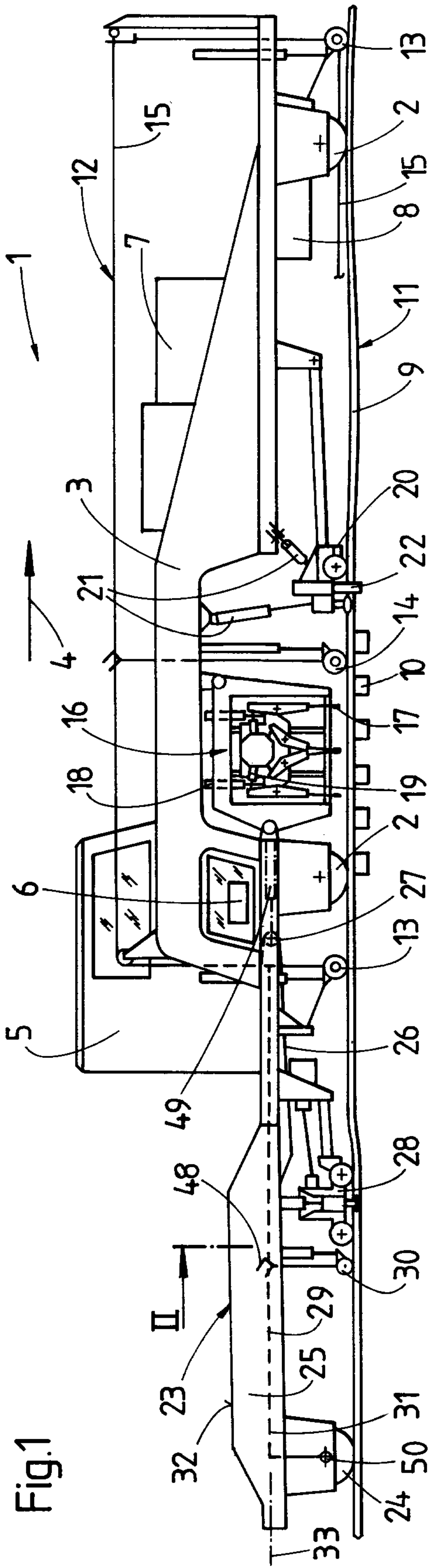


Fig. 1

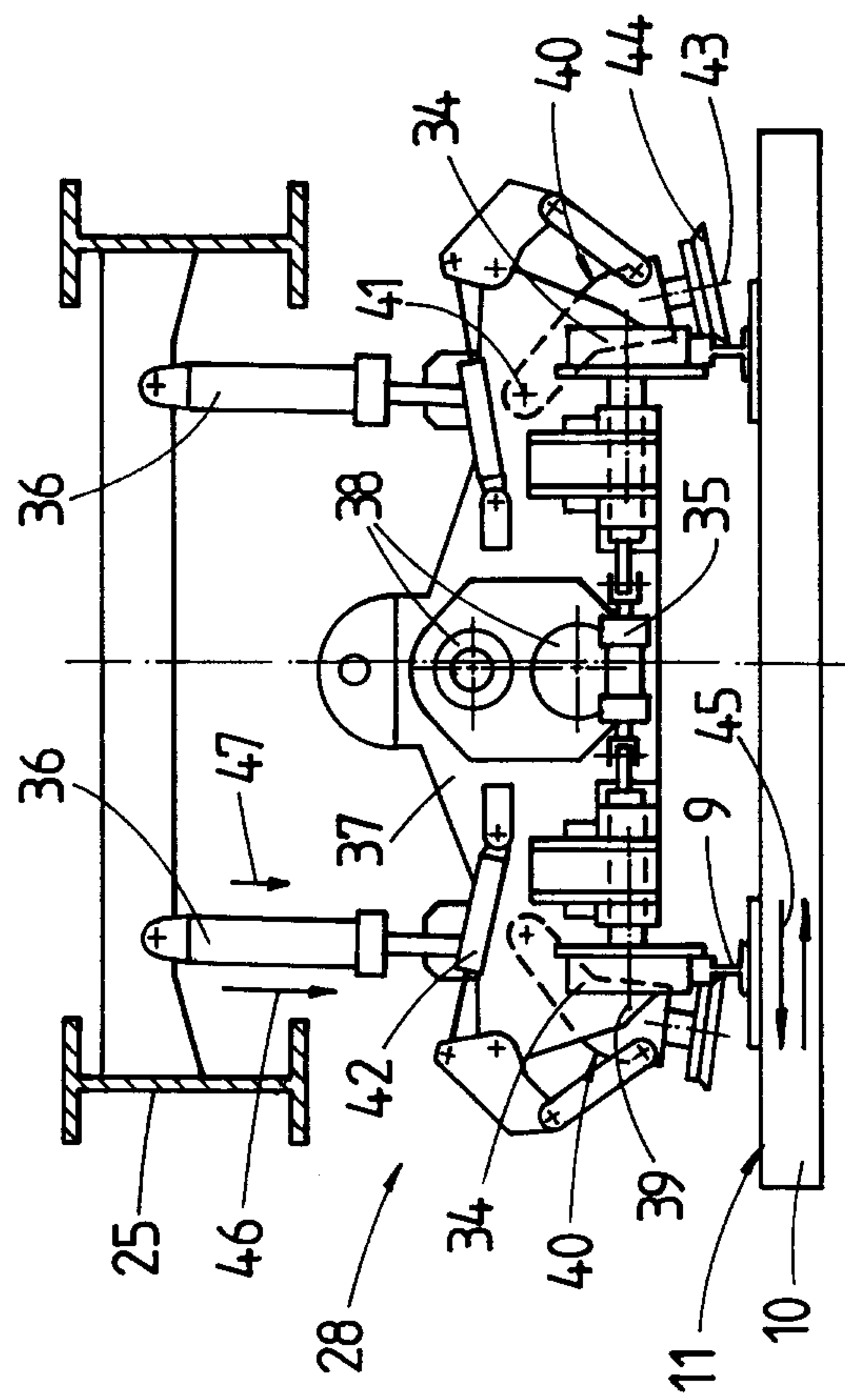


Fig. 2

