



(22) Date de dépôt/Filing Date: 2009/02/04

(41) Mise à la disp. pub./Open to Public Insp.: 2009/08/04

(62) Demande originale/Original Application: 2 652 329

(30) Priorité/Priority: 2008/02/04 (AT A 175/2008)

(51) Cl.Int./Int.Cl. *B21B 43/06* (2006.01),
B21B 39/04 (2006.01), *B65G 49/02* (2006.01),
C21D 1/02 (2006.01), *C21D 9/04* (2006.01)

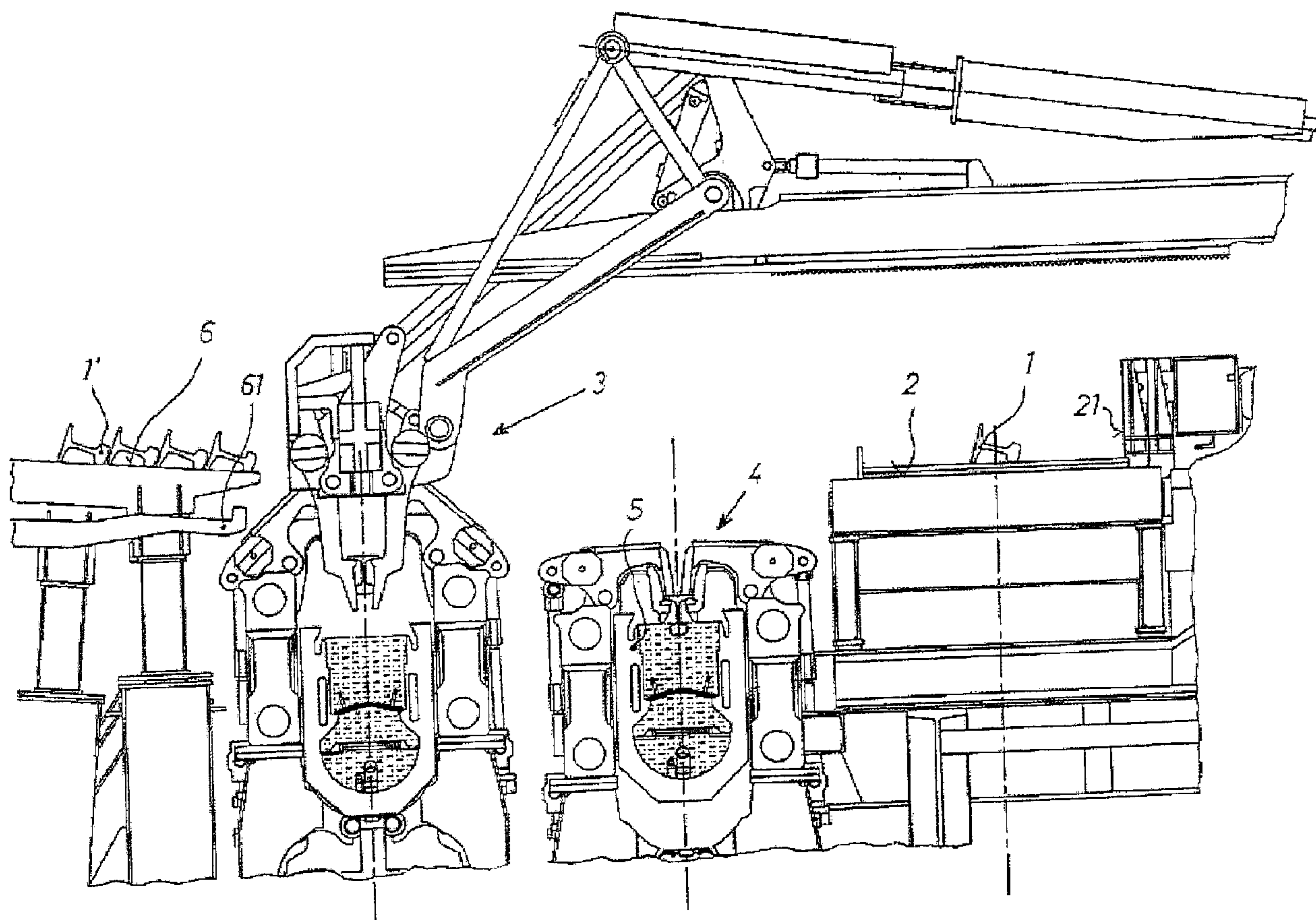
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(54) Titre : DISPOSITIF DE DURCISSEMENT DES RAILS

(54) Title: DEVICE FOR HARDENING OF RAILS



(57) Abrégé/Abstract:

The invention relates to a device for hardening of rails, in particular profiled track rails, each optionally having a different cross-sectional shape and a length of more than 50 meters, by cooling at least a portion of the respective rail cross section over the entire

(57) Abrégé(suite)/Abstract(continued):

length of the rail in a coolant, comprising transverse shunting means in the area of a roller gear, straightening means and manipulation grippers for conveying the rail in the device, at least one positioning means, each with a basin and/or trough with coolant and cooling bed. To create a device with which high quality rails can be manufactured economically with a high throughput and with a great reliability, it is proposed according to the present invention that the manipulation gripper should be formed from a plurality of identically shaped aligned tongs (30) that can be operated to have the same movement, each having gripper arms (31, 31') which are shaped with centering parts (312, 312') for an axial alignment of the head (12) of the rail and with gripper parts (311, 311') for a cross-sectionally aligned holding of the rail base, and a precision introduction of the rail (1) into the positioning means (4) and securing of same therein are made possible and/or the positioning means (4) has a plurality of holding components (40) aligned horizontally with supporting rigs (41) for the base (11) of a rail (1) introduced in a hanging position, said base (11) being securable on the supporting rigs (41) by releasable chucking elements (42) and/or hold-down devices so that it is secured from distortion in the axial rail (1) and/or at least basins (5) are arranged horizontally at the same height side-by-side so they are axially parallel with positioning means (4), and the part of the coolant (50) that can be used for rail hardening in the basin (5) has a depth which exceeds the height of the largest rail profile by at least 10% and/or the basin (5) and the supporting rigs (41) and the releasable chucking means (42) for the base (11) of the hanging rail (1) of all the components of the positioning means (4) can be moved in a controlled manner relative to one another vertically at the same time for introducing the rail into the coolant, and a respective vertical holding position and duration of same are adjustable.

Abstract

The invention relates to a device for hardening of rails, in particular profiled track rails, each optionally having a different cross-sectional shape and a length of more than 50 meters, by cooling at least a portion of the respective rail cross section over the entire length of the rail in a coolant, comprising transverse shunting means in the area of a roller gear, straightening means and manipulation grippers for conveying the rail in the device, at least one positioning means, each with a basin and/or trough with coolant and cooling bed.

To create a device with which high quality rails can be manufactured economically with a high throughput and with a great reliability, it is proposed according to the present invention that the manipulation gripper should be formed from a plurality of identically shaped aligned tongs (30) that can be operated to have the same movement, each having gripper arms (31, 31') which are shaped with centering parts (312, 312') for an axial alignment of the head (12) of the rail and with gripper parts (311, 311') for a cross-sectionally aligned holding of the rail base, and a precision introduction of the rail (1) into the positioning means (4) and securing of same therein are made possible and/or the positioning means (4) has a plurality of holding components (40) aligned horizontally with supporting rigs (41) for the base (11) of a rail (1) introduced in a hanging position, said base (11) being securable on the supporting rigs (41) by releasable chucking elements (42) and/or hold-down devices so that it is secured from distortion in the axial rail (1) and/or at least basins (5) are arranged horizontally at the same height side-by-side so they are axially parallel with positioning means (4), and the part of the coolant (50) that can be used for rail hardening in the basin (5) has a depth which exceeds the height of the largest rail profile by at least 10% and/or the basin (5) and the supporting rigs (41) and the releasable chucking means (42) for the base (11) of the hanging rail (1) of all the components of the positioning means (4) can be moved in a controlled manner relative to one another vertically at the same time for introducing the rail into the coolant, and a respective vertical holding position and duration of same are adjustable.

Figure 1

Device for Hardening of Rails

This is a divisional application of Canadian Patent Application Serial No. 2,652,329 filed on February 4, 2009.

The invention relates to a device for hardening of rails, in particular profiled track rails with optionally different cross-sectional shapes and a length of more than 50 meters, by cooling at least a portion of the respective rail cross section over the entire length of the rail in a coolant comprising transverse shunting means in the area of a roller gear, straightening means and manipulation grippers for moving them in the device, at least one positioning means with a basin and/or trough with coolant and a cooling bed.

It should be understood that the expression "the invention" and the like used herein may refer to subject matter in either the parent or the divisional applications.

Rails made of carbon steel, optionally a low alloy steel, which are placed on a cooling bed after being rolled and are left to cool have a pearlitic structure throughout, such that the material has corresponding mechanical properties. To reduce wear on the rails, in particular at high axial loads and optionally at a high speed of the trains and in tight curves, the structure can be adjusted according to the state of the art through a special heat treatment, such that at least the stressed rail head has a great hardness, a high abrasion resistance and a low crack initiation, i.e., the rail has improved use properties in the track.

A device for hardening of rails through a targeted design of the structure in cooling of same may be designed for continuous passage through a spray cooling device or for immersion in a coolant.

Continuous spray cooling systems for rail hardening usually have a simple design, but they have the disadvantage that they take up a great deal of space, require a complex technology and may also be unable to efficiently prevent unwanted fluctuations in the quality of the rails in a manufacturing process. In addition, accurate coordination of cooling with variable cross-sectional profiles such as switch rails, groove rails, Vignol rails and the like often cannot be accomplished to the required extent in a continuous spraying system, whereby distortion in cooling of cross-sectional areas in their passage [through the cooling system] may optionally also lead to uneven exposure to coolant and therefore to fluctuations in hardness of the material over the length of the rail.

It has already been proposed that in spray annealing of a rail, said rail should be left immobile or should be displaced only slightly in alternation, preferably by the respective distance of the spray means.

In addition, it is known that a device for thermal annealing of rails and/or parts of the cross section of rails may be designed with one or more immersion basins for same.

In sequential production of hardened rails with a high rolling output, it has already been proposed according to AT 410 549 B that at least two liquid cooling devices may be arranged in parallel to form one aligning means, and transverse conveyance means with supporting rigs for rolling goods between the roller gear rolls are provided to move a rail from the roller gear to manipulators of the cooling device and subsequently from the latter into the support area of a cooling bed. An increase in the throughput of rails through the annealing plant can be achieved in this way. However, discharge from the rolling stand, alignment and rotation of the rail on the roller gear are not possible to an unlimited extent with active aligning means.

This is where the present invention seeks to eliminate these shortcomings with the goal of creating a device of the type defined in the introduction for hardening of rails, in particular profiled track rails with which relatively high quality rails can be manufactured economically with a high throughput and with great reliability.

Specifically, a supporting rig should have the following, according to the set goals:

- Manipulation gripper for unhindered rapid transport of the rails discharged from the rolls, said gripper enabling an axial alignment of same, as well as making the rails conveyable into a positioning means with a high precision and/or deposition on a transfer means and/or to a cooling bed;
- Positioning means for deformation-free clamping and/or
- Quenching means which can be used in cooperation with positioning means such that
- Control means by which the system components can be coordinated with one another for cyclic immersion of the head and/or other parts of the cross section and/or the entire surface of the rail in the course of cooling of same.

The goal is achieved with a generic device when the manipulation gripper is formed by tongs with the gripper arms, each being shaped with centering parts for an axial alignment of the head of the rail and having gripping parts for a cross-sectionally aligned holding of the rail foot, thereby enabling a highly precise introduction of the rail into the positioning means and securing of same therein.

The advantages achieved with an inventive manipulation gripper can essentially be seen as the fact that its aligned tongs have gripper arms with centering parts and gripping parts, so that the rail can be aligned axially first at the head end immediately after the last rolling pass and discharge thereof on the roller gear in rolling heat, i.e., in the ductile state and/or in a largely plastic state of the material in closing the tong parts, whereupon the base of the rail is held in a cross-sectionally aligned position and rails are always brought into positioning means in the

same manner after axial rotation thereof or can be placed on a cooling bed. This type of placement of the rail in positioning means with a horizontally aligned, flush base of the hanging rail has the advantage that the position of the base of the rail is always similar in this way and this uniform position may also be secured even with asymmetrical cross-sectional profiles.

The tongs are at the same time designed to be rotatable in the same direction about a common axis with at least one angle to align the rails from different roller gear positions, e.g., from a horizontal position, to hold them so that they are cross-sectionally aligned and to be able to introduce them into positioning means in a highly precise manner by axial rotation.

Following the discharge of the rail from the positioning means, the rail may be transferred in an advantageous manner from a desired cross-sectional position to a transfer means and/or placed on a cooling bed by rotation of the tongs.

Transport of the aligned rails may be accomplished advantageously with a high precision in a short period of time if the manipulation gripper is formed with more than two tongs per 10 meters of basin length.

In terms of technical function and with regard to the alignment and gripping performance, it is advantageous if the tongs are each formed with a similarly movable and/or adjustable gripper arm.

If, in an advantageous manner, the manipulation gripper and the respective conveyance means are movable transversely over the roller gear with more than the greatest rail height and only the gripper arms of the tongs are vertically lowerable in part between the rollers of the roller gear in order to receive the rail, then the force acting upon the roller gear end area with rails discharged from the rollers remains undisturbed with respect to simultaneous conveyance of rails in the hardening device, which ensures a high flexibility and high performance of same and/or a high throughput.

The goal is also achieved with a device of the aforementioned type for hardening of rails according to the invention, such that the positioning means has a plurality of holding components with supporting rigs for the base of a rail which is introduced in a hanging position, said rail base being secured on the installations to prevent deformation by releasable chucking elements and/or hold-down devices and secured horizontally in the axial direction of the rails.

The advantages achieved with the positioning means according to the invention may be seen essentially in the fact that these are formed from horizontally aligned holding components with a

high precision, each having two supporting rigs and two hold-down devices. In this way, a rail from rolling heat with an austenitic structure, which is aligned axially in a certain desired position by a manipulation gripper, can be placed in the holding components, each with two supporting rigs for the base of the rail and secured in a displacement-proof and twist-proof manner by two chucking elements each said securing means also being preserved with a high precision even under exposure to high forces, e.g., in a cooling phase of the rail head. The holding components and the hold-down devices and/or chucking elements for the rail base are each provided similarly in the longitudinal extent of the positioning means, so that advantageously no bending moments occur when securing the rail.

It has proven advantageous if the rail is held immovably on both ends by a supporting rig and a releasable chucking element for the rail base of a component of the positioning means and the other supporting rigs and elements of the respective components allow displacement in the longitudinal direction of the rail. In this way, the rail may be stabilized in a desired cross-sectional position even during the cooling treatment and/or heat treatment, so that the shortening which is determined by the contraction of the material, occurs so that it is free of surface damage due to displacement.

A goal is achieved with a device for hardening of rails according to the preamble of the main claim due to the fact that at least two basins with positioning means are arranged side-by-side with parallel axes horizontally at the same height and the part of the coolant that can be used for hardening the rail has a depth in the basin that exceeds the height of the greatest rail profile by at least 10%.

The advantages of this feature of the invention are established mainly by a high performance which is achieved by means of two basins arranged so they are axially parallel and in particular the flexibility of the hardening device and the possibility of universal usability, optionally for sequential cooling to the full extent due to their controllable positioning means and/or cooling of parts of the cross section, e.g., exclusively the head or the running surface of a rail in the cooling medium. It is also possible with the device according to the invention to use a number of immersion parameters for the rails in the coolant and thus to achieve a desired structure distribution over the cross section of the rail.

According to a preferred embodiment of the invention, the basin has at least one coolant inlet at the bottom per 1.5 meter of basin length through which a regulated coolant flow can be passed, such that at least one perforated plate and/or flow-through plate is preferably arranged in the

basin above the coolant inlets at a distance from the former with sealing and/or a plate with nozzles or with ducts is used downstream in the direction of flow of the coolant.

Due to these inventive measures, the local cooling intensity of the coolant for the cross-sectional surface areas can be kept constant over the longitudinal extent of the rails and subsequently a high uniform quality which is desired in the production of hardened rails can be achieved.

When, according to one embodiment of the invention, draining means for the coolant are provided in the basin and/or in the feeder lines, these means being openable for brief emptying of the basin, then in the event of a problem, for example, the coolant can be discharged from the basin in the fastest possible amount of time, thereby interrupting rail hardening. This hardening interruption protects the device and permits easier discharge of a rail held in the basin when there is a problem in the system.

The goal of the invention to create a novel device for hardening of rails with different effective local cooling intensities over the cross section thereof is also achieved by the fact that the basin and the supporting rigs and the releasable chucking means are movable vertically at the same time relative to one another for the base of the hanging rails of all components of the positioning means for introducing the rail into the coolant and a respective vertical holding position and period of time therein are adjustable.

Such desired structural embodiments and structural areas having a different microstructure over the cross section can be achieved in rails to advantage, so that such rails can be manufactured with a favorable profile of properties for specific stresses.

To be able to optimize the hardness of the head and the distribution of mechanical material properties over the cross section of rails, optionally having different cross-sectional profiles, it is possible to provide for the supporting rig and the chucking means for the base of the hanging rail of all components of the positioning means to be adjustable horizontally across the basin at the same time.

Accordingly, in one aspect, the invention provides a device for hardening of rails, optionally each with a different cross-sectional shape and a length of more than 50 meters, by cooling at least a portion of the respective rail cross section over the entire length of the rail in a coolant comprising transverse shunting means in the area of a roller gear, straightening means and manipulation grippers for conveying the rail in the device, at least one positioning means, each with a basin and/or a trough with coolant, as well as a cooling bed;

wherein the manipulation gripper is formed by a plurality of identically shaped, aligned tongs that can be operated to move in the same way, having gripper arms each of which is shaped with centering parts for axial alignment of the head of the rail and with gripper parts for a cross-sectionally aligned holding of the rail base, to permit a precision introduction of the rail into the positioning means and securing of same therein.

In one aspect, the invention provides a device for hardening of rails, each optionally having a different cross-sectional shape and a length of more than 50 meters, by cooling at least a portion of the respective rail cross section over the total rail length, comprising transverse shunting means in the area of a roller gear, aligning means and manipulation grippers for conveying the rail in the device, at least one positioning means, with a basin and/or a trough with coolant as well as cooling bed, wherein the basin and the supporting rigs and the releasable chucking means for the base of the hanging rail of all components of the positioning means can be moved in a controlled manner simultaneously vertically relative to one another for introducing the rail into the coolant and a respective vertical holding position and duration of same can be adjustable.

The invention is explained in greater detail on the basis of drawings illustrating just one possible embodiment, with a list of reference numerals provided subsequently in the text.

Figure 1 shows a device for hardening of rails in cross section perpendicular to the longitudinal axis of the rail,

Figure 2 shows a rail in tongs of a manipulation gripper,

Figure 3 shows positioning means and basins perpendicular to the longitudinal axis of the rail,

Figure 4 shows cross-sectional profiles of rails.

To facilitate an overview with regard to the function parts of the invention, the list of reference numerals given below will be used:

1	rail
11	rail base
12	rail head
1Z	switch rail
1R	groove rail
1V	Vignol rail
y	axis of base means
x	axis of head means
A	axial deviation
H	height of rail
2	roller gear
21	transverse shunting means
3	manipulation gripper
30	tongs
31, 31'	gripper arms
311, 311'	gripper parts
312, 312'	centering parts
4	positioning aids
40, 40'	holding components
41, 41'	supporting rigs
42 42'	chucking elements
5	basins (trough)
50	coolant
51	flow-through plate
52	nozzle plate
53	coolant guidance device
54	coolant inlet
6	cooling bed
61	transfer means

Figure 1 shows a cross section of an embodiment of the invention. A rail 1 is placed on a roller gear 2 according to the pass in the last rolling caliber (not shown) and is positioned thereon by the transverse shunting means 21.

From a position on the roller gear 2, a rail 1 is picked up by means of a manipulation gripper 3 which has a plurality of tongs 30 with gripper arms 31, 31' over the length of the rail 1, as shown in Figure 2. The gripper arms 31, 31' are each shaped with centering parts 312, 312' for axial alignment of a rail head 12 and with gripper parts 311, 311' for holding a hanging rail base 11, such that the distance from the flange ends of the rail base 11 to the gripper arms 31, 31' is increased to axially align different rail profiles, represented as 1Z, 1R, 1V in Figure 4, at the head end by means of centering parts 312, 312' of tongs 30.

A manipulation gripper 3 according to the invention as illustrated in Figure 1 is designed so that it grips a rail 1 in a horizontal position on the roller gear 2 from this by means of a plurality of tongs 30 over the length of the rail and aligns it axially by holding it with the gripper arms 31, 31'. The tongs 30 are jointly movable vertically, horizontally and rotationally at a right angle to the axis of the rail by machine-designed parts with simultaneous clamping of the centering parts 312, 312', so that a rail situated laterally is picked up from the roller gear 2, aligned axially and rotated into a hanging position with a horizontal base area; this rail can be introduced into a positioning means 4 on supporting rigs 41, 41' as illustrated in Figure 3.

In the same way as shown in Figure 1, a rail 1, 1' can be picked up by the roller gear 2 or by a positioning means 4 and can be deposited on a cooling bed or on a transfer means 61.

An inventive positioning means 6 is illustrated in Figure 3 and has holding components 40, 40' with supporting rigs 41, 41' over the length of a rail 1 into which the rail 1 can be inserted in an axially aligned position. Chucking elements 42, 42' can be positioned on the flange ends of a rail base 1 in the direction of the supporting rigs 41, 41'. Positioning means 4 and basins 5 with coolant 50 cooperate in the hardening process of rails 1.

According to this invention, as Figure 1 shows, at least two basins 5 with coolant 50 are arranged side-by-side and axially parallel, such that the part of the coolant 50 which can be used for hardening a rail 1 in the basin 5 has a depth greater than the maximum rail height to allow complete immersion of same into the liquid coolant 50.

As Figure 3 shows, coolant inlet 54 and coolant guiding devices 53 are arranged on the bottom of the basin 5, such that flow-through plates 51 and/or nozzle plates 52 can be inserted toward the

immersion space to make the velocity of flow of the coolant 50 more uniform in oncoming flow toward a rail 1 over the entire length of the basin 5.

Positioning means 4 for rails 1 and basin 5 with coolant 50 work together as mentioned above and can be moved relative to one another by means of control devices (not shown) and can be positioned at least in the positions "immersion of cross-sectional parts" and/or "head hardening" and/or "complete immersion hardening" for periods of time.

For different cross-sectional profiles of rail 1, as illustrated in Figure 4 for a switch rail 1Z and a groove rail 1R in comparison with a Vignol rail 1V, axial deviations A_z , A_r between the head axis x and the base axis y may be given. To expose the main mass of a rail head 12 to an oncoming flow of coolant 50 in the immersion basin and to do so centrally regardless of the cross-sectional profile, a horizontal axially parallel positioning of the positioning means 4 and the basin 5 can be set up in accordance with the axial deviations A_z , A_x .

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A device for hardening of rails, each optionally having a different cross-sectional shape and a length of more than 50 meters, by cooling at least a portion of the respective rail cross section over the total rail length, comprising transverse shunting means in the area of a roller gear, aligning means and manipulation grippers for conveying the rail in the device, at least one positioning means, with a basin and/or a trough with coolant as well as cooling bed, wherein the basin and the supporting rigs and the releasable chucking means for the base of the hanging rail of all components of the positioning means can be moved in a controlled manner simultaneously vertically relative to one another for introducing the rail into the coolant and a respective vertical holding position and duration of same can be adjustable.
2. A device according to claim 1, wherein the supporting rigs and the chucking means for the base of the hanging rail of all components of the positioning means are adjustable horizontally across the basin at the same time.

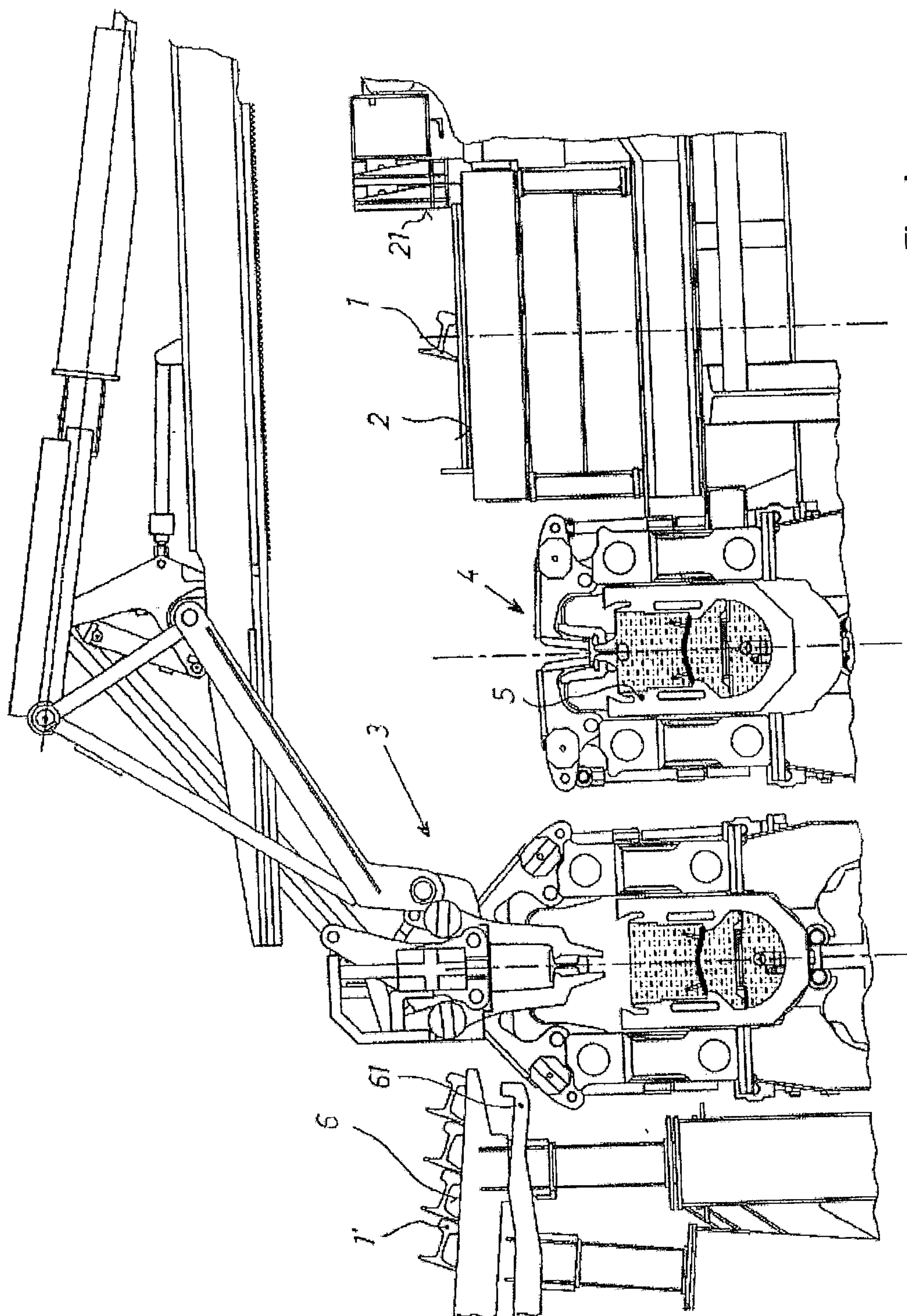


Fig. 1

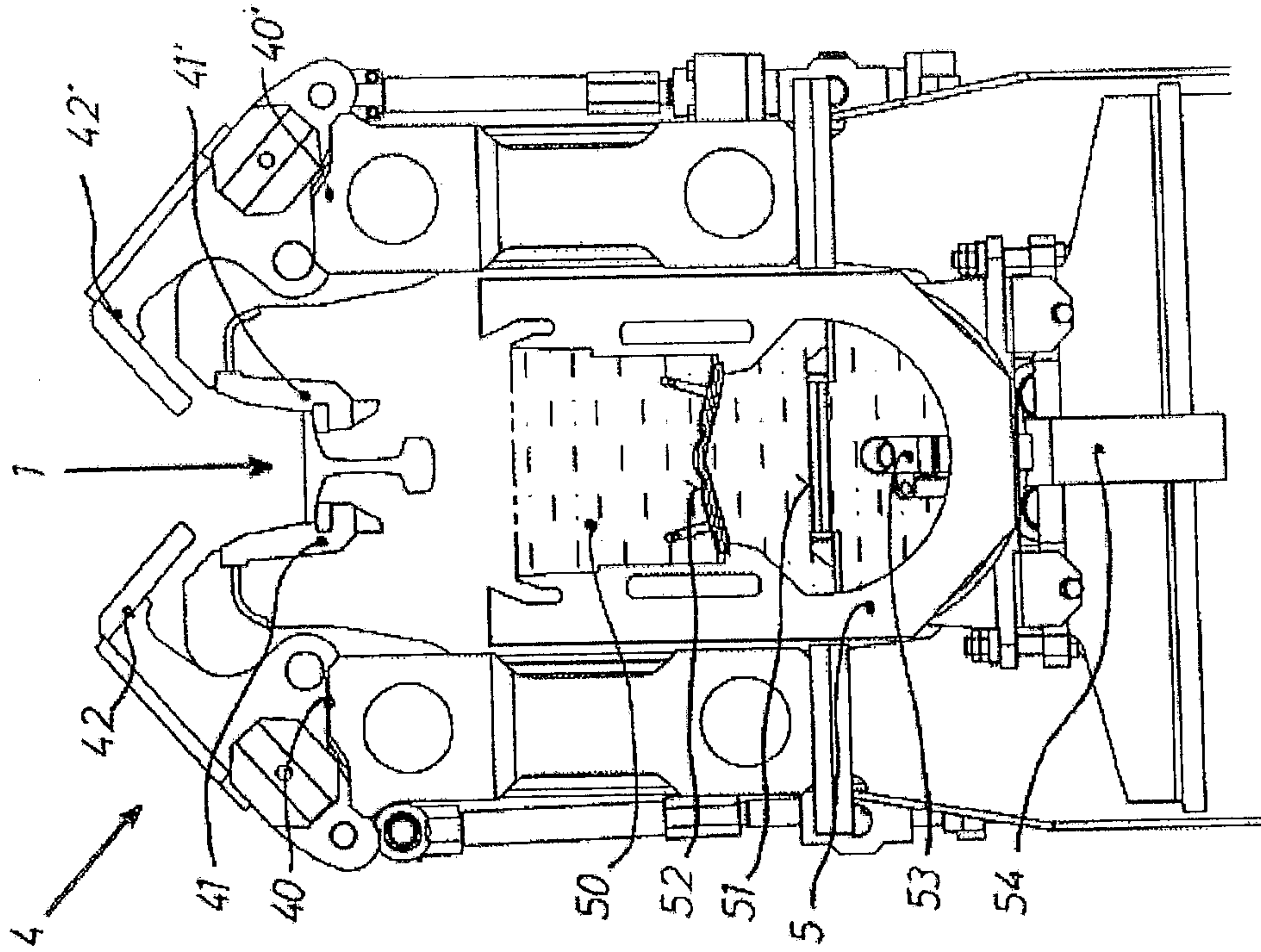


Fig. 2

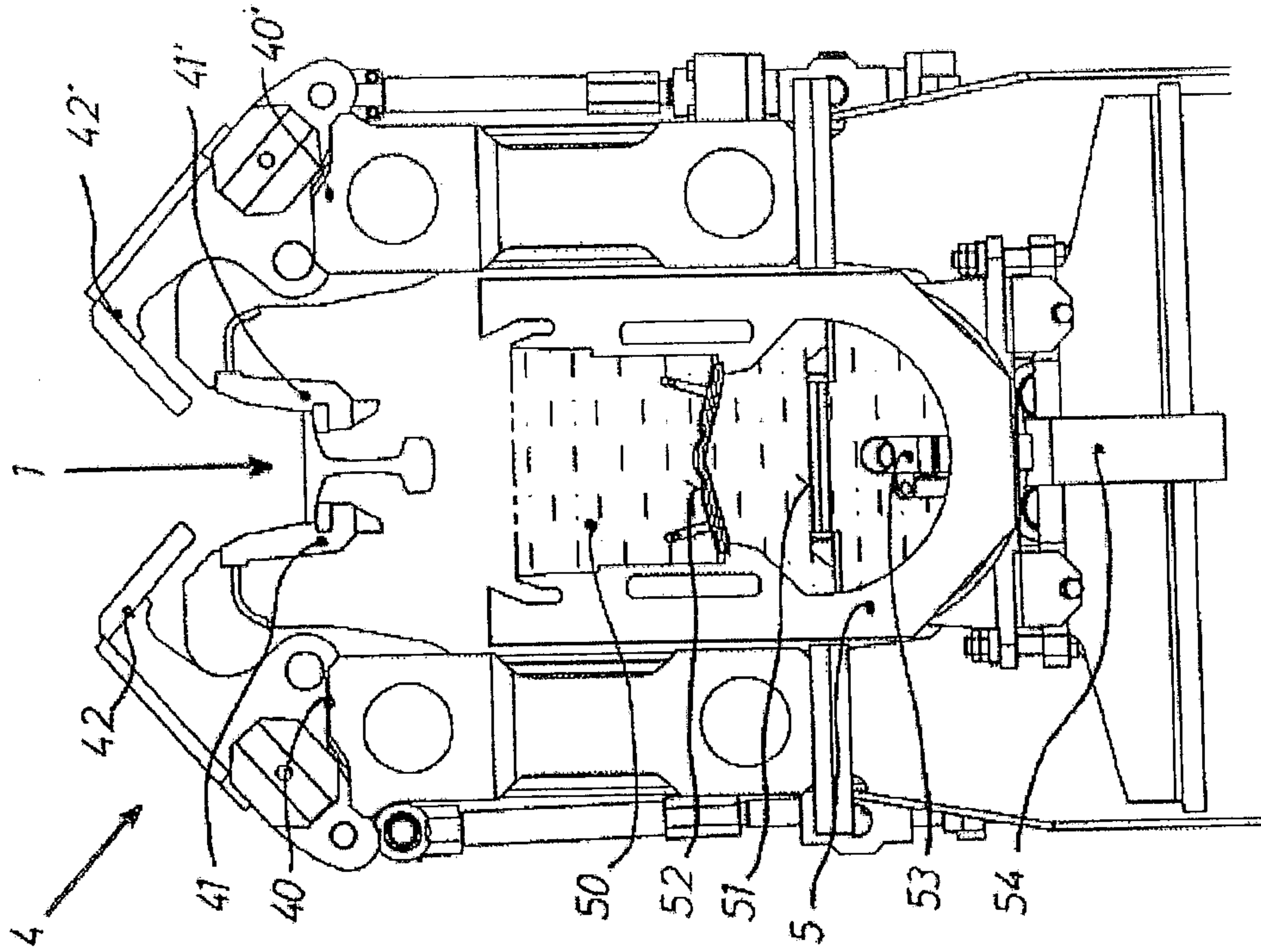
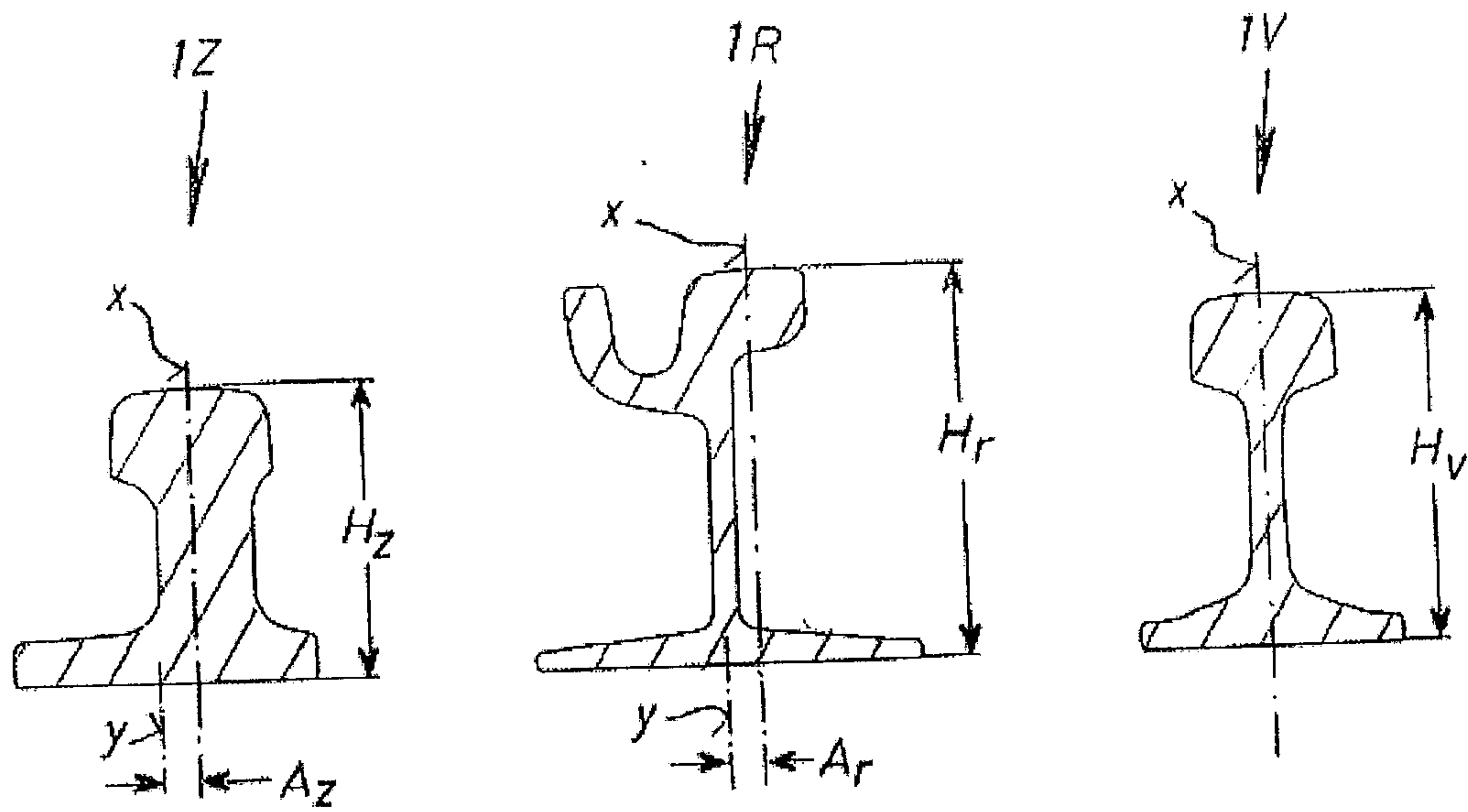


Fig. 3

Fig . 4

