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(54) **Introduction assembly for reinforcement rods for drilling machine**

(57) Introduction assembly (10) for reinforcement rods (39) for drilling machines (20) having at least a drilling assembly (30) able to make a plurality of holes inside which said reinforcement rods (39) are inserted, said introduction assembly (10) comprising at least a guide

beam or mast (28) for said reinforcement rods (39), normally arranged on one side of said drilling assembly (30), said mast (28) being able to assume at least a working configuration and a movement configuration wherein it is able to move from one side of said drilling assembly (30) to the other.

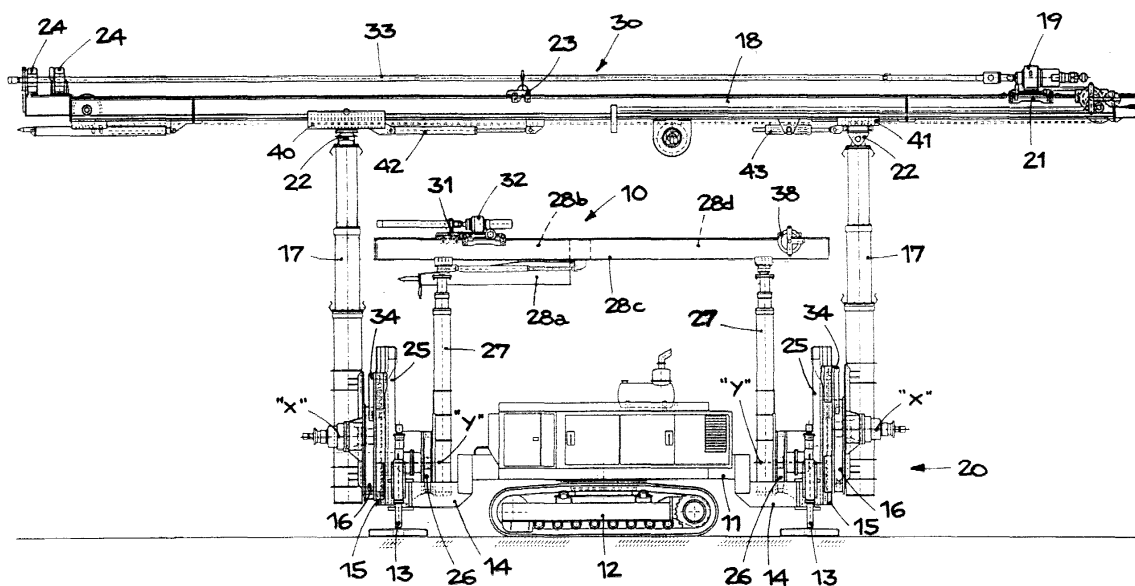


fig.2

Description

FIELD OF THE INVENTION

[0001] The invention concerns an introduction assembly for reinforcement rods in drilling machines advantageously but not exclusively employed to prepare excavations to make tunnels.

[0002] To be more exact, the invention is employed in machines used to make consolidation work in excavations of tunnels by making holes in the wall to be excavated, inside which holes suitable consolidation elements, also known as reinforcement rods, are inserted.

BACKGROUND OF THE INVENTION

[0003] The state of the art includes drilling machines used to prepare excavations for tunnels and able to make substantially horizontal holes in the wall which has to be excavated, and to introduce consolidation elements, also known as reinforcement rods.

[0004] Such drilling machines are provided with one or two drilling assemblies, each comprising a mast, or guide beam, on which one or more rotary heads are mounted sliding longitudinally; by means of said heads the drilling instrument, generally consisting of rod elements, is made to rotate to penetrate into the ground.

[0005] Each mast is also provided with guide elements suitable to keep the drill tool on its axis, and vice means able to allow the tool to be assembled and disassembled.

[0006] The masts are mounted by means of articulated joints provided for this purpose on telescopic columns attached to rotary plates and therefore able to assume a different extension and a different inclination according to the position where the holes have to be made.

[0007] The reinforcement rods are inserted into the ready prepared holes by means of introduction assemblies with which the drilling machines are provided and which in general are associated with the masts supporting the rotary head of the drilling tools.

[0008] The masts are therefore extremely heavy and cumbersome, with considerable limits in terms of movement and functionality.

[0009] Moreover, when the machine is working, when the reinforcement rods are picked up, positioned and inserted, the drilling of the holes must be interrupted, because it is impossible to use the mast simultaneously for drilling and for inserting the reinforcement rods.

[0010] This entails a longer time to complete the working cycle and the productivity of the drilling machine is reduced.

[0011] There have also been proposals for drilling machines in which the assembly to introduce the reinforcement rods comprises its own mast mounted on support and movement means which are autonomous with respect to those of the drilling assembly.

[0012] In this embodiment, however, there is the prob-

lem of interference between the masts and the means which support and move the working assemblies, especially when the latter are operating in a close position.

[0013] Moreover, the working assemblies cannot cross over with respect to each other and therefore the drilling assembly has to stay always on one side of the introduction assembly and vice versa.

[0014] On the one hand this can oblige the workers to interrupt the working cycle of one of the two assemblies when it has to assume a position which is not operationally useful, and on the other hand it limits the angle of rotation and hence the working area of both assemblies.

[0015] The present Applicant has devised and embodied this invention to overcome these shortcomings and to obtain other advantages.

SUMMARY OF THE INVENTION

[0016] The invention is set forth and characterized in the main claim, while the dependent claims describe other characteristics of the invention.

[0017] The purpose of the invention is to achieve an introduction assembly for reinforcement rods for drilling machines which can operate simultaneously with the mating drilling assembly, without interfering with the latter, irrespective of its position, thus allowing to optimize the working cycle of the drilling machine on which it is installed.

[0018] Another purpose is to achieve an introduction assembly for reinforcement rods which, in its movement of rotation, can cross over with the mating drilling assembly, so as to be able to operate substantially inside the whole area to be drilled.

[0019] The introduction assembly for reinforcement rods according to the invention comprises a mast, or guide beam, of the folding type able to assume at least an extended working configuration, and a folded for movement configuration in which it is able to move from one side to the other of the drilling assembly of the drilling machine, allowing a mating movement of the introduction assembly.

[0020] The mast is associated with a pair of supporting shafts of the telescopic type mounted on rotary means able to make it perform an angular excursion such as to cover the whole area to be drilled, in order to selectively arrange the introduction assembly between two positions in proximity with the ground arranged on opposite sides with respect to the drilling machine.

[0021] In its folded for movement configuration, the mast is able to be contained longitudinally in the space defined by the column-type supporting elements of the drilling assembly so that, by means of the relative shaft elements and the rotary means on which these are mounted, the introduction assembly can pass below the drilling assembly and position itself on the opposite side to that where it was initially operating.

[0022] In a preferential embodiment, the mast comprises a plurality of segments, connected to each other

by means of hinge elements, which in the extended working configuration are aligned longitudinally and in the folded for movement configuration are arranged substantially adjacent to each other.

[0023] In this embodiment the segments are folded and extended by actuator means connected to the segments by lever means.

[0024] In one embodiment of the invention, a toothed profile is associated with the mast and mobile trolleys are engaged thereon, supporting centering and/or rotation means for said reinforcement rods and/or supporting and winding means for the hydraulic equipment of the drilling machine.

[0025] The mobile trolleys, with the relative means which they support, are able to be moved to allow the correct folding of the mast.

[0026] The introduction assembly according to the invention is therefore able to be moved from one side to the other of the mating drilling assembly and is therefore able to operate, without interfering with the latter, over the whole area to be drilled.

[0027] This, together with the fact that in order to move the introduction assembly it is not necessary to interrupt the hole-making operations, allows to obtain a greater productivity of the drilling machine on which it is installed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] These and other characteristics of the invention will become clear from the following description of a preferential form of embodiment given as a non-restrictive example with reference to the attached drawings wherein:

Fig. 1 is a side view of a drilling machine provided with the introduction assembly for reinforcement rods according to the invention in a first operating condition;

Fig. 2 shows the drilling machine in Fig. 1 in a second operating condition;

Fig. 3 is a schematic view of a transverse section of the drilling machine in Fig. 1 with the introduction assembly in a different position;

Fig. 4 is a schematic front view of the drilling machine in Fig. 2 with the introduction assembly in a different position;

Figs. 5 and 6 show a side view of the introduction assembly according to the invention respectively in the operating condition and in a first step of folding the mast;

Figs. 7 and 8 show a view from above of two steps of folding the mast of the introduction assembly of Figs. 5 and 6.

DETAILED DESCRIPTION OF A PREFERENTIAL EMBODIMENT

[0029] With reference to the attached Figures, a drilling machine 20 provided with the introduction assembly 10 for reinforcement rods according to the invention is able to be used to prepare excavations to make tunnels.

[0030] To be more exact, it is used to make a plurality of holes, in correspondence with the excavation face, inside which holes mating reinforcement rods 39 are inserted.

[0031] The drilling machine 20 comprises a frame 11 mounted on a truck 12 with tracks and provided with four, hydraulically driven stabilizer rods 13 able to rest on the ground to prevent the truck 12 from moving when the drilling machine 20 is operating.

[0032] On the front and on the rear side the frame 11 extends in two extensions 14, each of which is provided with a relative support 15.

[0033] On the two supports 15 respective rotary plates 16 are mounted, with a horizontal axis of rotation "x" substantially aligned and lying on the longitudinal median plane "Z" of the drilling machine 10.

[0034] Two relative columns 17, of the telescopic type and independently driven, are associated with the two rotary plates 16. They are able to perform an angular excursion α such as to cover the whole area to be drilled (Fig. 4).

[0035] Each rotary plate 16 is mounted on a respective slider 34 able to slide on a vertical guide stanchion 25 arranged in a position inside the columns 17 on the longitudinal median plane "Z" of the drilling machine 20.

[0036] The columns 17 support a drilling assembly 30 comprising a mast, or guide beam, 18 along which a rotary head 19 is mounted sliding on a trolley 21 and able to make the tools or drilling rods 33 rotate.

[0037] The mast 18 is associated with the relative columns 17 by means of articulated joints 22 which allow it to be possibly inclined in order to achieve non-horizontal holes.

[0038] On the two articulated joints 22 are mounted mating guide elements, respectively front 40 and rear 41, on which the mast 18 is able to slide axially by adjusting two cylinders 42 and 43 associated therewith.

[0039] The system defined by the two cylinders 42 and 43 and by the guide elements 40 and 41 not only allows a uniform distribution of the stresses of the drilling assembly 30 on the two columns 17, but also it allows to vary the inclination of the mast 18 and the amplitude of the angles between the columns 17 when such conditions become necessary to make the holes, without danger of breakages and/or damage to the drilling assembly 30.

[0040] A centering trolley 23, able to keep the drilling rods 33 in position, is also mounted on the mast 18, and also two vices 24 which permit to mount and remove the drill rods 33 during the working cycle.

[0041] Each extension 14 also supports a respective

motorized rotary plate 26 with a horizontal axis of rotation "y" parallel to the axis "x".

[0042] On each rotary plate 26 a telescopic shaft 27 is mounted, able to make an angular excursion β , according to the rotation of the respective rotary plate 26, so as to cover the whole area to be drilled (Fig. 3).

[0043] The two shafts 27 support an introduction assembly 10, used to insert the reinforcement rods 39 into the holes prepared by the drilling assembly 30.

[0044] The introduction assembly 10 is able to be arranged selectively between a first position near the ground on one side of the drilling machine 20 and a second position near the ground on the other side of the drilling machine 20.

[0045] The introduction assembly 10 comprises a relative mast, or guide beam, 28 connected to the shafts 27 by means of articulated joints 29 which allow it to incline due to the action of an actuator 35.

[0046] According to a characteristic feature of the invention, the mast 28 is of the folding type and, in its folded condition, that is, in its condition of minimum extension, is able to be arranged in the space defined between the two columns 17.

[0047] To be more exact, the mast 28 is made in four segments, connected together by hinge joints 36, in order from the front end to the rear end: first 28a, second 28b, third 28c and fourth 28d.

[0048] The segments 28a-28d are able to be selectively folded one on top of the other by activating a lower actuator 47 and two lateral actuators, front 48 and rear 49.

[0049] The lower actuator 47 has its shaft 47a constrained at the point of conjunction of two levers, a stationary lever 50 associated with the first segment 28a, and an oscillating lever 51 associated with the second segment 28b.

[0050] The front lateral actuator 48 in turn has its shaft 48a constrained at the point of conjunction of a stationary lever 52 associated with the second segment 28b, and an oscillating lever 53 associated with the third segment 28c.

[0051] In a specular fashion, the rear lateral actuator 49 has its shaft 49a constrained at the point of conjunction of a stationary lever 54 associated with the fourth segment 28d, and an oscillating lever 55 associated with the third segment 28c.

[0052] When the shafts 47a, 48a, 49a of the actuators 47, 48, 49 are all in their extended position, the mast 28 is in its working configuration wherein it assumes its maximum extension and has the relative segments 28a-28d aligned longitudinally (Figs. 1 and 5).

[0053] On the contrary, when the shafts 47a, 48a, 49a are all in their retracted position, the mast 28 is in its folded position of movement, wherein it assumes its minimum extension and has the segments 28a, 28b and 28d substantially adjacent to the third segment 28c (Figs. 2 and 8).

[0054] The mast 28 is provided at the upper part with

a toothed profile 37 (only partly shown in the drawings) which is also made in segments with an equal extension to that of the segments 28a-28d.

[0055] In a first embodiment, the toothed profile 37 consists of a rack.

[0056] According to a variant, the toothed profile 37 consists of a chain.

[0057] Three trolleys, a first 44, a second 45 and a third 46, are engaged on, and able to slide along, the toothed profile 37; a centering element 31 able to keep the reinforcement rods 39 on axis, a mandrel 32 able to make said reinforcement rods 39 rotate to facilitate their insertion into the holes, and an assembly 38 to support and wind the hydraulic equipment are mounted respectively on said trolleys 44, 45 and 46.

[0058] The movement of the trolleys 45, 46 is imparted by two speed reduction units mounted thereon; the first trolley 44 is able to be moved by the second trolley 45 to which it is connected by means of a cable 56 kept constantly under tension by a tensioning device mounted on the second trolley 45.

[0059] The first trolley 44 normally assumes the position shown in Fig. 1, in which it is kept stationary, even when the second trolley 45 moves back, by a stop element 57.

[0060] During the working cycle of the drilling machine 20, the introduction assembly 10 is arranged on one side of the drilling assembly 30 and operates simultaneously therewith, since it is completely independent therefrom.

[0061] When, for operating requirements, the introduction assembly 10 has to move to the other side of the drilling assembly 30, the mast 28 is taken to its folded configuration in which it is contained longitudinally between the two columns 17 and is made to pass below the drilling assembly 30.

[0062] To be more exact, with reference to Figs. 5-8, the mast 28 is folded quickly and completely automatically, as follows:

First, the mandrel 32 and the supporting and winding assembly 38, which in the extended configuration of the mast 28 are arranged on the fourth segment 28d (Fig. 5), are made to advance onto the third segment 28c by means of the relative trolleys 45, 46 moved by the speed reduction units; also the centering element 31, already arranged on the third segment 28c, is made to advance slightly.

[0063] In a preferential embodiment, the third trolley 46 is drawn by the second trolley 45 and its speed reduction unit has a braking function, so that it makes a lower travel than that of the second trolley 45, in this case equal to about half.

[0064] The first trolley 44, on the contrary, is pushed by the second trolley 45 when the latter moves to the advanced position, with the tensioning device winding the connecting cable 56.

[0065] Subsequently, the front actuator 47 is activated to make the first segment 28a fold under the second segment 28b (Fig. 6).

[0066] Then, the two lateral actuators 48 and 49 are activated simultaneously, and take respectively the second segment 28b, with the first segment 28a, and the fourth segment 28d to a position adjacent to the third segment 28c (Fig. 7).

[0067] The mast 28 has thus assumed its folded configuration and can thus be made to rotate, by means of the rotary plates 26 on which the shafts 27 are mounted, into the inner space between the two columns 17 in order to be taken to the opposite side of the drilling assembly 30; then the mast 28 is returned to its extended configuration to allow the introduction assembly 10 to start operations again.

[0068] In the meantime, the drilling assembly 30 has always continued working and therefore the interruption to the working cycle of the drilling machine 20 has affected the introduction assembly 10 only for a short period.

[0069] It is obvious however that modifications and/or additions can be made to the introduction assembly 10 as described heretofore, but these shall remain within the field and scope of this invention.

[0070] For example, the mast 28 can consist of a larger or smaller number of segments, or be folded in a different way.

[0071] Or instead of the toothed profile 37, there may be other types of guide means, for example a cable, for the trolleys 44, 45, 46.

[0072] It is also obvious that, although the description refers to specific examples, a person of skill shall certainly be able to achieve many equivalent forms of introduction assembly for reinforcement rods, all of which shall come within the field and scope of the invention.

Claims

1. Introduction assembly for reinforcement rods (39) for drilling machines (20) having at least a drilling assembly (30) able to make a plurality of holes inside which said reinforcement rods (39) are inserted, said introduction assembly comprising at least a guide beam or mast (28) for said reinforcement rods (39), normally arranged on one side of said drilling assembly (30), the introduction assembly being **characterized in that** said mast (28) is able to assume at least a working configuration and a movement configuration wherein it is able to move from one side of said drilling assembly (30) to the other.
2. Introduction assembly as in Claim 1, **characterized in that** said mast (28) assumes a condition of maximum extension in said working configuration and assumes a folded condition in said movement configuration.
3. Introduction assembly as in Claim 1 or 2, wherein

said drilling assembly (30) is supported by at least a pair of supporting column elements (17), **characterized in that** said mast (28), in said movement configuration, is able to be contained at least longitudinally in the space defined between said pair of column elements (17).

4. Introduction assembly as in any claim hereinbefore, **characterized in that** said mast (28) is mounted on at least a pair of supporting shafts (27) of the telescopic type.
5. Introduction assembly as in Claim 4, **characterized in that** said shafts (27) are associated with respective rotary means (26) able to make it make an angular excursion (β) such as to cover the whole area to be drilled in order to selectively arrange said introduction assembly (10) between two extreme positions near the ground arranged on opposite sides of said drilling machine (20).
6. Introduction assembly as in any claim hereinbefore, **characterized in that** said mast (28) comprises a plurality of segments (28a, 28b, 28c, 28d) which in said working configuration are aligned longitudinally and in said movement configuration are arranged substantially adjacent to each other.
7. Introduction assembly as in Claims 2 and 6, **characterized in that** said segments (28a, 28b, 28c, 28d) are connected to each other by means of hinge elements (36) and are able to be folded one on top of the other by means of actuators (47, 48, 49).
8. Introduction assembly as in Claim 7, **characterized in that** said actuators (47, 48, 49) are connected to said segments (28a, 28b, 28c, 28d) by means of levers (50, 51, 52, 53, 54, 55).
9. Introduction assembly as in Claim 7 or 8, **characterized in that** said mast (28) consists of four segments in order, first (28a), second (28b), third (28c) and fourth (28d), and **in that**, in said movement configuration, said first segment (28a) is arranged below said second segment (28b) while the latter and said fourth segment (28d) are arranged beside said third segment (28c).
10. Introduction assembly as in any claim hereinbefore, wherein at least centering means (31) and/or rotation means (32) for said reinforcement rods (39) and/or means (38) to support and wind the hydraulic equipment of said drilling machine (20) are mounted on said mast (28), **characterized in that** said mast (28) is associated with a sliding profile (37) along which said means (31, 32, 38) are able to be moved.

11. Introduction assembly as in Claims 9 and 10, **characterized in that** said means (31, 32, 38) are able to be arranged in correspondence with said third segment (28c) in said movement configuration. 5
12. Introduction assembly as in Claim 10 or 11, **characterized in that** said sliding profile (37) is of the toothed type.
13. Introduction assembly as in Claim 12, **characterized in that** said sliding profile (37) consists of a rack. 10
14. Introduction assembly as in Claim 12, **characterized in that** said sliding profile (37) consists of a chain. 15
15. Introduction assembly as in any Claim from 10 to 14 inclusive, **characterized in that** said sliding profile (37) is made in segments of a length mating with that of the segments (28a, 28b, 28c, 28d) of said mast (28). 20
16. Introduction assembly as in any Claim from 10 to 15 inclusive, **characterized in that** said means (31, 32, 38) are mounted on respective mobile trolleys (44, 45, 46) engaged on said sliding profile (37). 25
17. Introduction assembly as in Claim 16, **characterized in that** speed reduction means are connected to said mobile trolleys (44, 45, 46) to perform the movement thereof. 30
18. Introduction assembly as in Claim 16 or 17, **characterized in that** at least one of said mobile trolleys (44) is connected by means of a cable (56) to a second mobile trolley (45) and is able to be moved by the latter. 35
19. Introduction assembly as in any Claim from 16 to 18 inclusive, **characterized in that** at least one (44) of said mobile trolleys is able to cooperate with stop means (57) arranged on said mast (28). 40

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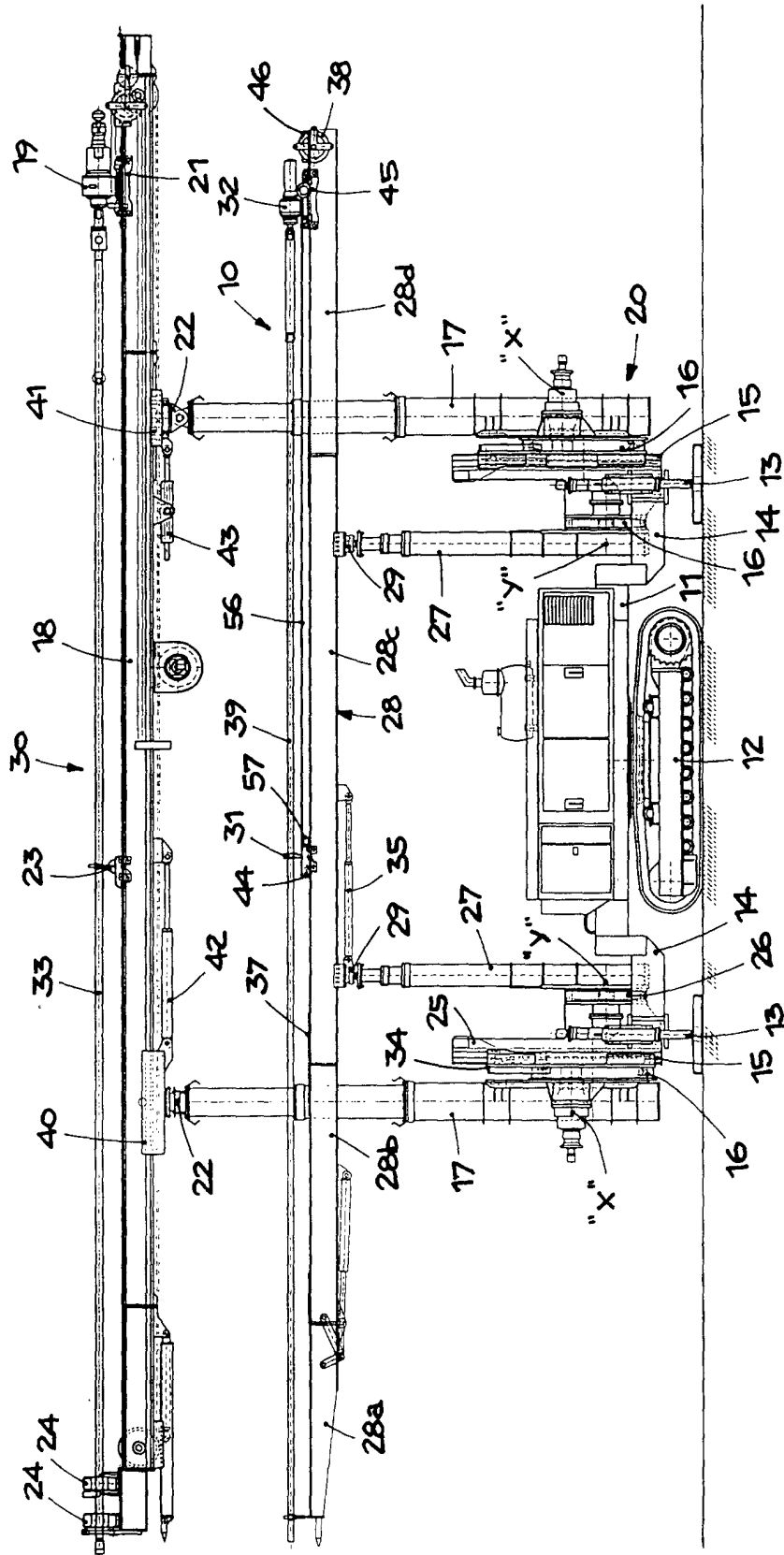


fig. 1

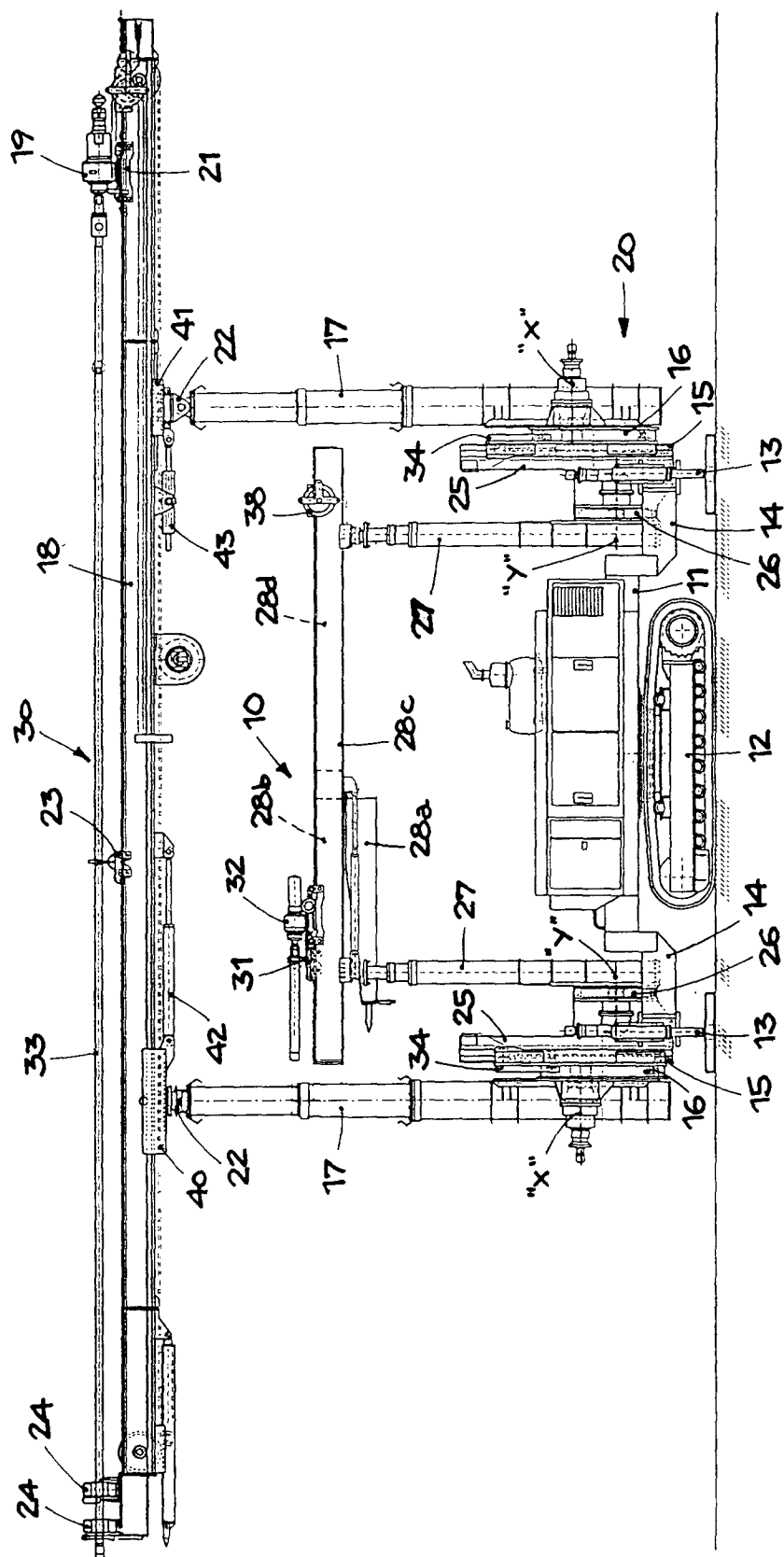


fig. 2

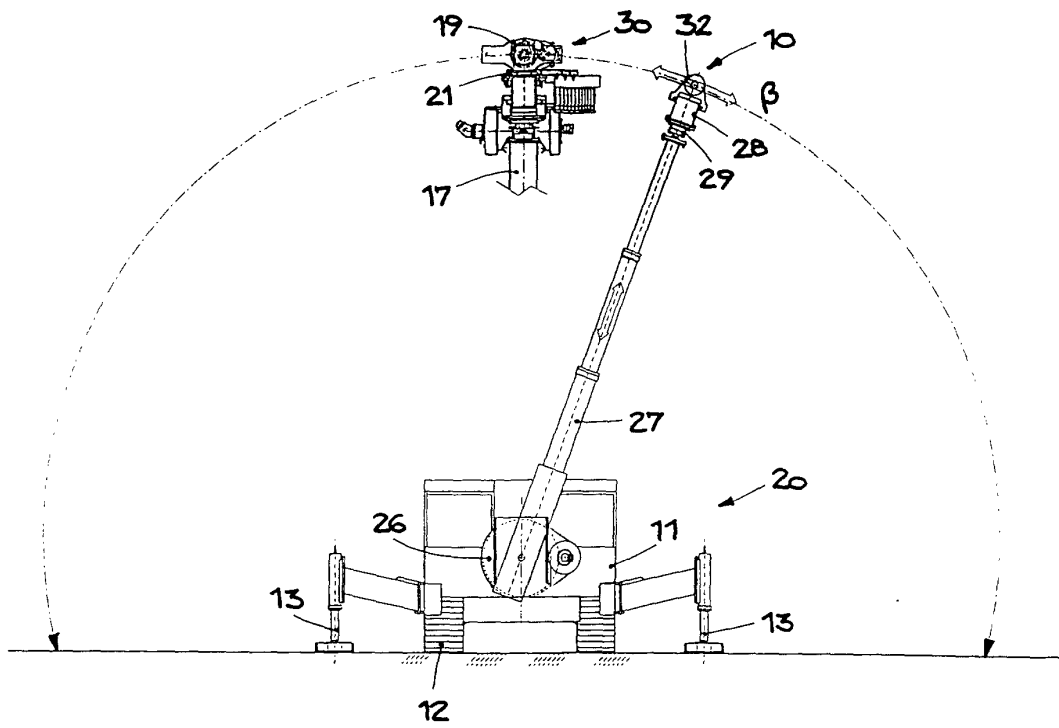


fig.3

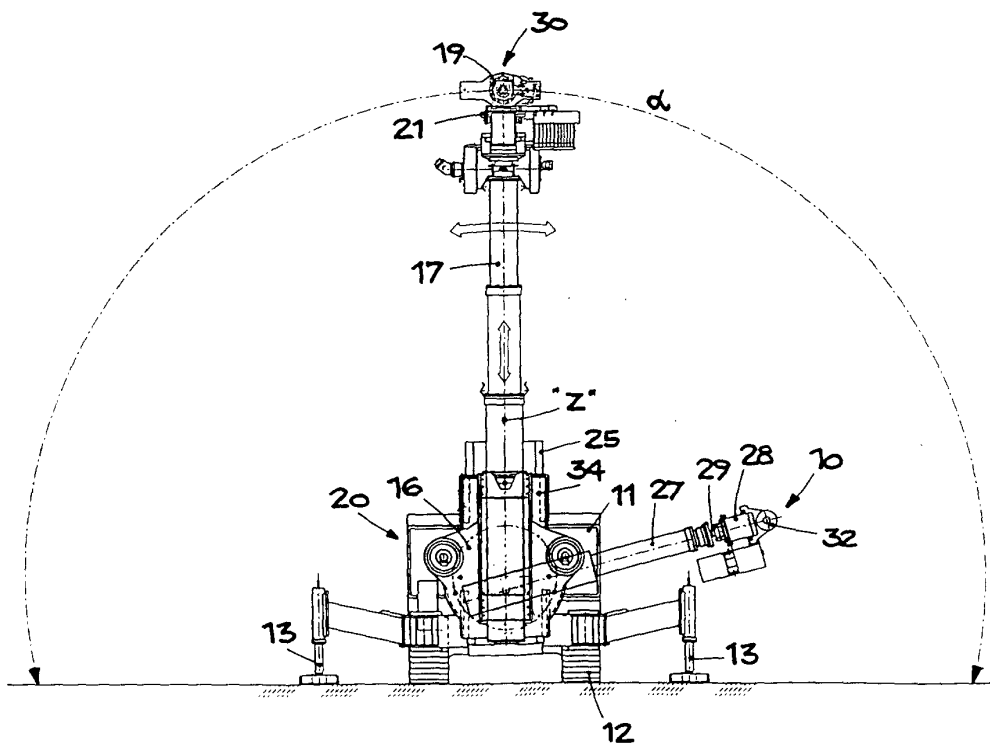
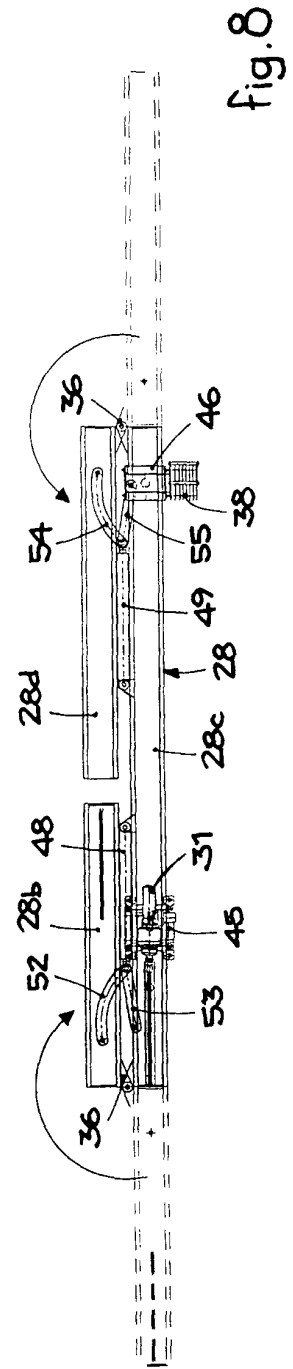
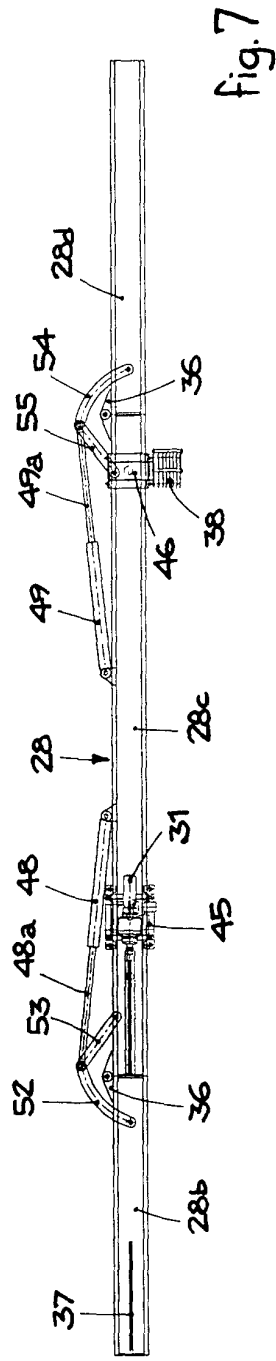
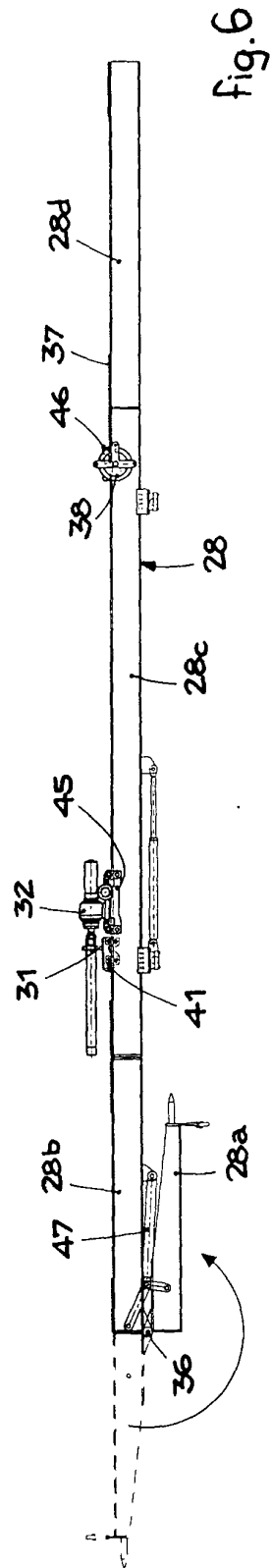
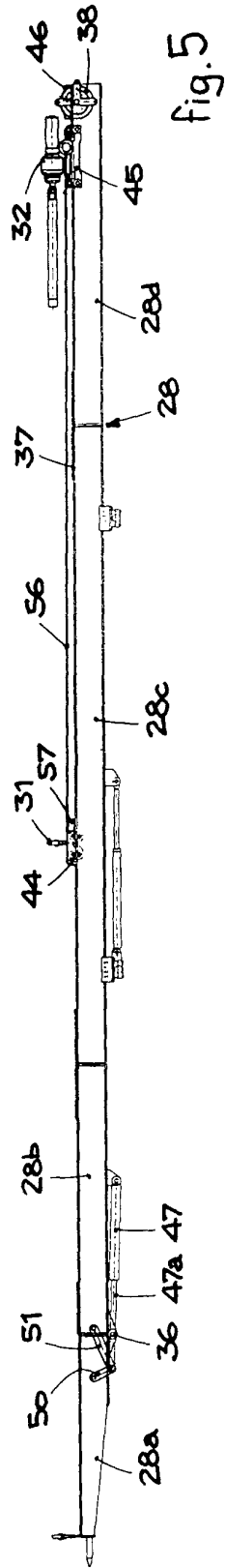


fig.4





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 11 4640

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 0 424 779 A (CASAGRANDE SPA) 2 May 1991 (1991-05-02) * abstract; figures * ---	1	E21B15/04 E21D20/00 E21B19/00 E21B7/02 E21C11/00 E21D9/10
A	EP 0 424 768 A (CASAGRANDE SPA) 2 May 1991 (1991-05-02) * the whole document * ---	1	
A	US 4 785 892 A (LUEN LAM M) 22 November 1988 (1988-11-22) * figures * ---	1,16-19	
A	US 3 295 800 A (KARL ERIK) 3 January 1967 (1967-01-03) * figures 1,2 * ---	1,2,6-8	
A	FR 1 325 564 A (ATLAS COPCO) 2 August 1963 (1963-08-02) * figures * ---	1	
A	FR 2 711 178 A (BOUYGUES SA) 21 April 1995 (1995-04-21) ---		TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	EP 0 424 733 A (CASAGRANDE SPA) 2 May 1991 (1991-05-02) ---		E21B E21D E21C
A	DE 28 36 659 A (EBELING WOLFGANG DIPL ING) 6 March 1980 (1980-03-06) -----		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 8 October 2001	Examiner Fonseca Fernandez, H
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 01 11 4640

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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08-10-2001

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
EP 0424779	A	02-05-1991	IT	1236444 B	09-03-1993
			EP	0424779 A1	02-05-1991
			JP	3158593 A	08-07-1991
EP 0424768	A	02-05-1991	IT	1236445 B	09-03-1993
			EP	0424768 A1	02-05-1991
			JP	3158591 A	08-07-1991
			US	5129764 A	14-07-1992
US 4785892	A	22-11-1988	CN	85108010 A ,B	10-05-1986
			CN	85108187 A ,B	10-04-1986
			CN	85108188 A ,B	10-04-1986
			GB	2166780 A ,B	14-05-1986
			GB	2166781 A ,B	14-05-1986
			GB	2169334 A ,B	09-07-1986
			JP	61172919 A	04-08-1986
			JP	61176788 A	08-08-1986
			US	4703811 A	03-11-1987
			EP	0215998 A2	01-04-1987
US 3295800	A	03-01-1967	CH	424689 A	30-11-1966
			FI	41824 B	01-12-1969
			NO	115049 B	15-07-1968
FR 1325564	A	02-08-1963	NONE		
FR 2711178	A	21-04-1995	FR	2711178 A1	21-04-1995
EP 0424733	A	02-05-1991	IT	1236446 B	09-03-1993
			EP	0424733 A1	02-05-1991
			JP	3158592 A	08-07-1991
			US	5116164 A	26-05-1992
DE 2836659	A	06-03-1980	DE	2836659 A1	06-03-1980

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82