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(71) Applicant: **OMNIA Srl**
55049 Viareggio (LU) (IT)

(72) Inventors:
- **Serafin, Luigi**
  31047 Negrisia Di Ponte Di Piave (TV) (IT)
- **Perazzini, Giancarlo**
  55054 Bargecchia Di Massarosa (LU) (IT)

(74) Representative: **Petraz, Gilberto et al**
GLP S.r.l.
Piazzale Cavedalis 6/2
33100 Udine (IT)

(54) Apparatus for the maintenance of viaducts

(57) Apparatus (10) for the maintenance of road, motorway or rail viaducts (11), with at least two bays (44) defined by piers (15) to support the roadway/railway on said viaducts (11), said apparatus comprising substantially horizontal guide means (14) constrained to said piers (15) and a platform (12) mounted able to slide on said guide means (14) to be moved below the soffit (43) of the viaduct (11), said platform (12) being able to move from one of said bays (44) to the other, transiting laterally to each of said piers (15).

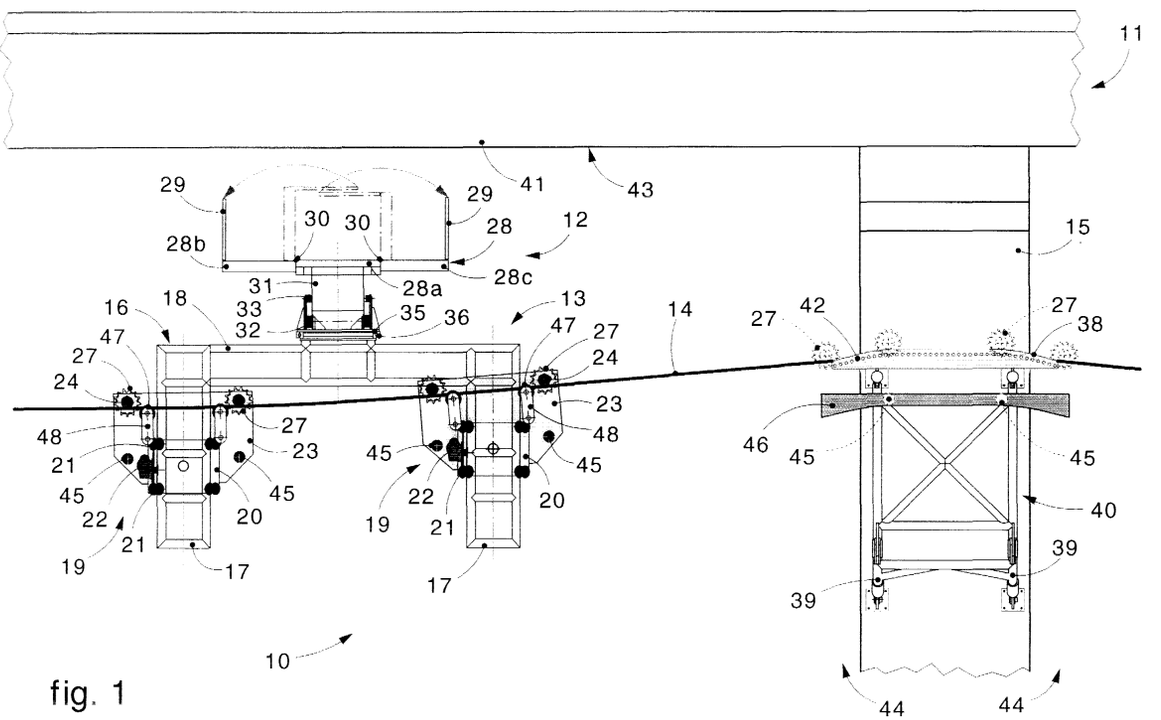

fig. 1

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Description

FIELD OF THE INVENTION

[0001] The invention concerns an apparatus able to be used in the maintenance of the structural parts of road, motorway or railway viaducts.

[0002] The invention is suitable to be installed below the roadway or railway part of the viaduct, to support the staff and equipment needed to perform maintenance operations on the structural parts of the viaduct.

BACKGROUND OF THE INVENTION

[0003] At present, to support the staff and equipment needed to perform maintenance operations on the structural parts of viaducts, and particularly on the girders and/or the slab of the roadway/railway, in the state of the art two different systems are used.

[0004] A first system provides to make an arch-shaped scaffolding extending, below the viaduct, from one pier to the other and from the base of the viaduct to the soffit.

[0005] This system has a series of disadvantages and limitations due to the times required for assembling and dismantling the scaffolding, which is quite unstable and has limited bearing capacity, especially in correspondence with the central zone.

[0006] The system with scaffolding therefore entails particularly high construction costs and does not allow to use particular equipment which would be too heavy or cumbersome.

[0007] Moreover, if the maintenance concerns two or more bays of the viaduct, it is necessary to dismantle and re-assemble the scaffolding for each bay which is to be maintained or, alternatively, to prepare a scaffolding for each of the bays.

[0008] The second system, which is, however, normally only used on road viaducts, provides to use particular vehicles located on the roadway/railway of the viaduct and equipped with a platform, suspended cantilevered outside the same, able to support the maintenance staff and the relative equipment.

[0009] The platform necessarily is of limited size and has a limited bearing capacity, so that it is not suitable for use in particular applications.

[0010] Moreover, it cannot be positioned beyond a certain distance from the side of the viaduct, and therefore it does not always allow to intervene in the central zone of the soffit.

[0011] Furthermore, the presence on the roadway/railway of a vehicle with a platform requires that the carriageway has to be reduced, with a consequent restriction for the passing traffic.

[0012] The present Applicant has devised and embodied this invention to overcome these shortcomings, and to obtain further advantages.

SUMMARY OF THE INVENTION

[0013] The invention is set forth and characterized in the main claim, while the dependent claims describe other characteristics of the invention.

[0014] The purpose of the invention is to achieve an apparatus comprising a structure suitable to support equipment and staff to maintain viaducts and able to be moved from one bay to the other of the viaducts, without having to be dismantled and re-assembled.

[0015] Another purpose of the invention is to provide an apparatus which can be applied to both road and rail viaducts without needing to occupy the roadway/railway on said viaducts.

[0016] A further purpose of the invention is to achieve an apparatus which is stable and secure, even if it is applied to viaducts which are very high and have bays of a considerable length, and which will allow to reach any point whatsoever of the soffit of the viaduct.

[0017] The apparatus according to the invention comprises a platform able to be moved, below the soffit of the viaduct, on guide means which are longitudinally constrained on the outer sides of the piers of the viaduct and which extend substantially for the entire length thereof.

[0018] The platform is also able to transit by the side of the viaduct, so as to pass from one bay of the viaduct to the other without needing to be dismantled and re-assembled.

[0019] The fact that the guide means are constrained to the piers of the viaduct allows to discharge the weight of the platform, and the loads exerted thereon, onto the piers themselves.

[0020] This allows to apply even considerable loads onto the platform, since the piers of the viaduct are abundantly oversized, for safety reasons.

[0021] In the preferential embodiment, the platform is assembled on two trolleys, able to slide on respective guide means on opposite sides with respect to the piers of the viaduct, and is able to translate crosswise to move onto only one of the trolleys; when it passes from one bay to the other, the platform is also able to rotate on the trolley to move into alignment with the relative guide means and hence reduce its transverse bulk, thus more easily passing the pier.

[0022] According to a variant, the platform is also able to be folded back, so as to further reduce its bulk as it passes from one bay to the other.

[0023] In a preferential embodiment the platform is provided with self-levelling means able to keep it permanently in a horizontal condition.

[0024] According to another variant, the platform comprises buttressing and stabilizing means able to be forced under pressure against the soffit of the viaduct to make the platform more stable during use.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] 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 an apparatus to maintain viaducts according to the invention in the working configuration;
Fig. 2	shows the apparatus of Fig. 1 in its configuration of non-use;
Fig. 3	is a part view of a cross section of the apparatus in Fig. 1;
Fig. 4	is an enlarged detail of Fig. 3;
Figs. 5-13	show the platform of the maintenance apparatus according to the invention in its movement cycle between two bays.

DETAILED DESCRIPTION OF PREFERENTIAL EMBODIMENT

[0026] With reference to the attached Figures, an apparatus 10 for the maintenance of viaducts 11 according to the invention comprises a platform 12 assembled on a pair of trolleys 13, each able to slide on a relative pair of cables 14 which are horizontally aligned, substantially parallel to the viaduct 11 and suspended at the sides of the piers 15 of the latter.

[0027] The platform 12, which has transverse dimensions correlated to the roadway/railway of the viaduct 11, comprises a base 28 made in three sections of equal transverse extension: a central section 28a and two lateral sections, a first 28b and second 28c, provided with parapets 29, of which the second 28c is shorter than the first 28b.

[0028] The lateral sections 28b and 28c are constrained to the central section 28a by means of hinges 30 which, when the platform 12 is not in use, allow the sections 28b and 28c to fold back by 90° upwards with the parapets 29 overlapping, thus allowing a considerable reduction in the space occupied longitudinally by the platform 12.

[0029] The central section 28a is attached at the lower part to a transverse sliding element 31 which in normal conditions rests, by means of its own lateral profiles 34, on two distinct lower guides 32 with rollers, each guide being associated with a relative trolley 13.

[0030] To be more exact, each lower guide 32 with rollers is attached to its own plate 35 which also supports an upper guide 33 with rollers, which slides and cooperates at the upper part with the lateral profiles 34; each plate 35 is associated with a turntable 36, able to make it rotate with respect to a vertical axis by activating appropriate means (not shown here) and assembled on a relative trolley 13.

[0031] According to a variant, only one plate 35 is associated with a turntable 36, while the other is assembled directly on the relative trolley 13.

[0032] Each trolley 13 comprises a portal 16 made with a reticular structure and having two uprights 17 and a crosspiece 18.

[0033] Each upright 17 is associated with a relative lifting device 19 comprising a frame 20 supporting a plurality of wheels 21 associated with a reduction unit 22 able to make them rotate to make them slide along the upright 17.

[0034] Activating the reduction units 22 causes the trolleys 13 to be raised/lowered, and hence the platform 12 assembled thereon, according to the height at which the platform 12 is to be positioned.

[0035] On every frame 20 a cage 23 is assembled oscillating and supports two pairs of wheels 24, two for every cable 14 on which the trolley 13 slides.

[0036] Each wheel 24 has a central throat 25 around the circumference, by means of which it rests on the relative cable 14, and is associated internally with a pinion 26 and externally with a toothed wheel 27 coaxial to said wheel 24.

[0037] The pinion 26 is able to make the wheel 24 and the toothed wheel 27 rotate, driven by appropriate motor means which are not shown in the Figures.

[0038] There are two pairs of contrasting rollers 47 on each cage 23, which are able substantially to thrust the cables 14 upwards and tension them to make them adhere better to the wheels 24.

[0039] The contrasting rollers 47 are assembled on respective levers 48 able to selectively assume a raised position, wherein they cause the cables 14 to be tensioned by the contrasting rollers 47 (Fig. 1), and a lowered position wherein they distance the contrasting rollers 47 from the cables 14 and are arranged substantially parallel to the latter (Fig. 2 in a line of dashes).

[0040] The cages 23 are also provided with two pairs of idle stabilizing rollers 45 arranged below each pair of wheels 24 and toothed wheels 27.

[0041] In one embodiment which is not shown here, telescopic buttressing means are associated to the uprights 17 of the portals 16, able to be constrained under pressure to the girders 41, or in any case to the soffit 43, of the viaduct 11 to make the platform 12 more stable while the maintenance operations are being performed.

[0042] The apparatus 10 also comprises a plurality of relative supporting structures 40 attached laterally to each pier 15 by means of anchoring elements 39 the extension of which can be regulated.

[0043] On each of the supporting structures 40 a pair of rails 38 is mounted on which the wheels 24 are able to slide and inside which saddles 37 are attached able to support the cables 14.

[0044] Outside the rails 38, and substantially for the whole length thereof, a plurality of pins 42 are attached, defining substantially a rack on which the toothed wheels 27 are able to engage.

[0045] Below the rails 38 there is also a pair of C-

shaped profiles 46, arranged specular to each other and with the open side facing inwards, inside which the stabilizing rollers 45 of the cages 23 are able to slide.

[0046] According to the invention, while the maintenance operations of the girders 41 or other structural parts of the viaduct 11 are in progress, the platform 12, which is below the soffit 43, rests on both the trolleys 13 supported by the cables 14 (Fig. 5).

[0047] In this working configuration, the platform 12 is completely open, that is to say, with the lateral sections 28b and 28c extended, and is able to support the maintenance equipment and staff.

[0048] The horizontal condition of the platform 12 is ensured by the self-levelling function of the cages 23 and of the relative frames 20.

[0049] In fact, when the trolleys 13 slide on cables 14 inclined or bent due to the weight of the platform 12 itself, the cages 23 oscillate with respect to the frames 20 while the latter slide with the relative wheels 21 on the uprights 17 of the portals 16; the portals 16 are not therefore subject to any inclination and keep the platform 12 in a horizontal condition (Fig. 1).

[0050] In the course of the maintenance operations, the platform 12 is able to be moved along the cables 14 by means of the wheels 24 of the trolleys 13 made to rotate by the appropriate motor means.

[0051] This movement is facilitated by the thrust and tensioning action exerted by the contrasting rollers 47 which allow the wheels 24 to grip better on the cables 14, thus ensuring that the trolleys 13 advance in a continuous and uniform manner.

[0052] When the platform 12 has to be taken from one bay 44 to the other of the viaduct 11 to continue the maintenance operations, the following method is followed.

[0053] After evacuating the platform 12, the two lateral sections 28b and 28c of the base 28 are folded upwards (Figs. 2 and 6) and the levers 48 of the front cages 23 of the trolleys 13 are taken to the lowered position; the platform 12 is then moved substantially into close contact with the pier 15 which divides the two bays 44 (Fig. 7).

[0054] In this position the wheels 24 of the front cages 23 rest on the rails 38 and the corresponding toothed wheels 27 engage on the pins 42; the levers 48 and the contrasting rollers 47 are inserted between the rails 38 and the C-shaped profiles 46 inside which the stabilizing rollers 45 rest (Fig. 3).

[0055] The platform 12 is then made to translate transversely to take it to rest on one trolley 13 only, that is to say, on the trolley 13 provided with the turntable 36; to be more exact, the sliding element 31 is moved along the roller guides 32 and 33 until it is centered on the trolley 13 (Fig. 8).

[0056] The platform 12 is subsequently made to rotate through 90° on the turntable 36 so as to be arranged adjacent to an outer side of the pier 15 and in a position parallel to the cables 14 (Fig. 9).

[0057] During these translation and rotation steps of the platform 12, the stabilizing rollers 45 located inside the C-shaped profiles 46 ensure considerable stability to the trolley 13, preventing any twisting thereof, or any transverse displacement or oscillation on a vertical plane, and hence more generally any movement which might release it from the cables 14 and from the rails 38.

[0058] After taking also the levers 48 of the rear cages 13 to the lowered position, the two trolleys 13 are made to advance simultaneously, with the wheels 24 and the toothed wheels 27 passing respectively on the rails 38 and the pins 42 and the stabilizing rollers 45 which slide inside the C-shaped profiles 46.

[0059] Subsequently, after the base 28 of the platform 12 has passed beyond the pier 15, the platform 12 is made to rotate by another 90°, returning to the orthogonal position with respect to the cables 14 (Fig. 10).

[0060] During the entire step wherein the platform 12 rests on a single trolley 13, the wheels 24, the toothed wheels 27 and the stabilizing rollers 45 of at least one cage 23 are always resting respectively on the rails 38, the pins 42 and the C-shaped profiles 46, so that the platform 12 is stably supported on a single side of the pier 15.

[0061] Once it has passed beyond the pier 15, the platform 12 is made to translate transversely, by moving the sliding element 31 on the roller guides 32 and 33, until it is returned to rest on both trolleys 13 (Fig. 11).

[0062] Then the platform 12 is made to advance along the bay 44 so as to distance itself from the pier 15 (Fig. 12) and to allow the subsequent rotation of the lateral sections 28b and 28c of the base 28 to return the platform 12 to the open position and hence to the working condition (Fig. 13).

[0063] The entire apparatus 10 can be driven and regulated remotely by means of a command and control unit, not shown in the drawings, which can be installed on the ground.

[0064] In a preferential embodiment, the trolleys 13 can be moved along the same bay 44 by means of command means provided on board the platform 12.

[0065] It is obvious however that modifications and/or additions can be made to the apparatus 10 as described heretofore, without departing from the spirit and scope of the invention.

[0066] Thus, the trolleys 13 can be configured in a different manner and/or can move on rigid guides, for example of the rail type, instead of on cables 14.

[0067] It is also obvious that, although the invention has been described with reference to specific examples, a skilled person shall be able to achieve many other equivalent forms of an apparatus for the maintenance of viaducts, all of which shall come within the field and scope of this invention.

Claims

1. Apparatus for the maintenance of road, motorway or rail viaducts (11), with at least two bays (44) defined by piers (15) to support the roadway/railway on said viaducts (11), the apparatus being characterized in that it comprises substantially horizontal guide means (14) constrained to said piers (15) and a platform (12) mounted able to slide on said guide means (14) to be moved below the soffit (43) of the viaduct (11), said platform (12) being able to move from one of said bays (44) to the other, transiting laterally to each of said piers (15).

2. Apparatus as in Claim 1, characterized in that said guide means (14) extend substantially for the entire length of said viaduct (11).

3. Apparatus as in Claim 1, characterized in that said guide means (14) are constrained on the outer sides of said piers (15).

4. Apparatus as in Claim 1, characterized in that said guide means comprise cables (14) supported by supporting structures (40) attached to said piers (15).

5. Apparatus as in Claim 4, characterized in that said supporting structures (40) comprise supplementary guide means (38, 42) on which said platform (12) is able to move in its displacement from one of said bays (44) to the other.

6. Apparatus as in Claim 4, characterized in that said supporting structures (40) are attached to said piers (15) by means of anchoring elements (39) with a variable extension.

7. Apparatus as in Claim 1, characterized in that said platform (12) is assembled on two trolleys (13) each able to move along its own guide means (14), substantially parallel to said viaduct (11) and opposite each other with respect to said piers (15), said platform (12) being able to translate transversely with respect to said guide means (14) to move to rest on a single trolley (13) in its displacement from one of said bays (44) to the other.

8. Apparatus as in Claim 7, characterized in that said platform (12) is associated with a transverse sliding element (31) able to cooperate with mating guide means (32, 33) provided on each of said trolleys (13), to translate said platform (12).

9. Apparatus as in Claim 7, characterized in that at least said trolley (13) on which said platform (12) rests as it passes from one bay (44) to the other is provided with means (36) able to make said platform (12) rotate with respect to a vertical axis to move it to a position substantially parallel to said guide means (14).

10. Apparatus as in Claim 7, characterized in that each trolley (13) comprises a bearing element (16) able to support said platform (12), and oscillating elements (23), constrained to said bearing element (16), able to support the sliding means (24, 27, 45) of said trolley (13).

11. Apparatus as in Claims 4 and 10, characterized in that said sliding means comprise at least grooved wheels (24) able to move along said cables (14).

12. Apparatus as in Claims 5 and 11, characterized in that said oscillating elements (23) support contrasting means (47) able to thrust said cables (14) upwards and tension them in order to improve the grip of said wheels (24) on said cables (14).

13. Apparatus as in Claims 5 and 12, characterized in that said contrasting means (47) are able to assume a position of non-interference with said cables (14) as the platform (12) is displaced from one of said bays (44) to the other.

14. Apparatus as in Claims 5 and 11, characterized in that said wheels (24) are able to slide on rail-type guide means (38), associated with said supporting structure (40), at least as the platform (12) is displaced from one of said bays (44) to the other.

15. Apparatus as in Claims 5 and 10, characterized in that said sliding means comprise toothed wheels (27) able to engage on rack-type guide means (42), associated with said supporting structure (40), at least as the platform (12) is displaced from one of said bays (44) to the other.

16. Apparatus as in Claims 5 and 10, characterized in that said sliding means comprise stabilizing rollers (45) able to slide inside guide and containing means (46), associated with said supporting structure (40), at least as the platform (12) is displaced from one of said bays (44) to the other.

17. Apparatus as in Claim 16, characterized in that said guide and containing means comprise C-shaped profiles (46) open towards the inside and able to prevent the transverse and vertical displacement of the trolley (13).

18. Apparatus as in Claim 1, characterized in that said platform (12) is associated with lifting means (19) able to lift/lower it to vary its position with respect to said soffit (43).

19. Apparatus as in Claims 10 and 18, characterized in that said lifting means (19) are able to move the bearing elements (16) of said trolleys (13) vertically.

20. Apparatus as in Claim 19, characterized in that said lifting means (19) comprise frames (20) provided with wheels (21) associated with motor means (22) and able to move said bearing elements (16).

21. Apparatus as in Claims 10 and 20, characterized in that said lifting means (19) and said oscillating elements (23) have a self-levelling function for said platform (12).

22. Apparatus as in Claim 1, characterized in that said platform (12) is associated with buttressing and stabilizing means able to be constrained under pressure on the soffit (43) or on the girders (41) of said viaduct (11).

23. Apparatus as in Claim 1, characterized in that said platform (12) is provided with a base (28) divided into three sections, a central section (28a) and two lateral sections (28b and 28c), said lateral sections (28b and 28c) being able to be folded towards said central section (28a) to reduce the bulk of said platform (12).

24. Apparatus as in Claim 23, characterized in that at least said lateral sections (28b, 28c) are provided with parapets (29).

25. Apparatus as in Claims 23 and 24, characterized in that said lateral sections (28b, 28c) have a different longitudinal extension so that they can be folded towards said central section (28a) without any interference between the relative parapets (29).

26. Apparatus as in Claim 1, characterized in that it comprises a command and control unit which can be installed on the ground and able to allow the apparatus to be regulated and driven remotely.

27. Apparatus as in Claim 1, characterized in that said platform (12) is provided on board with command organs able to allow the apparatus at least to be moved along the same bay (44).

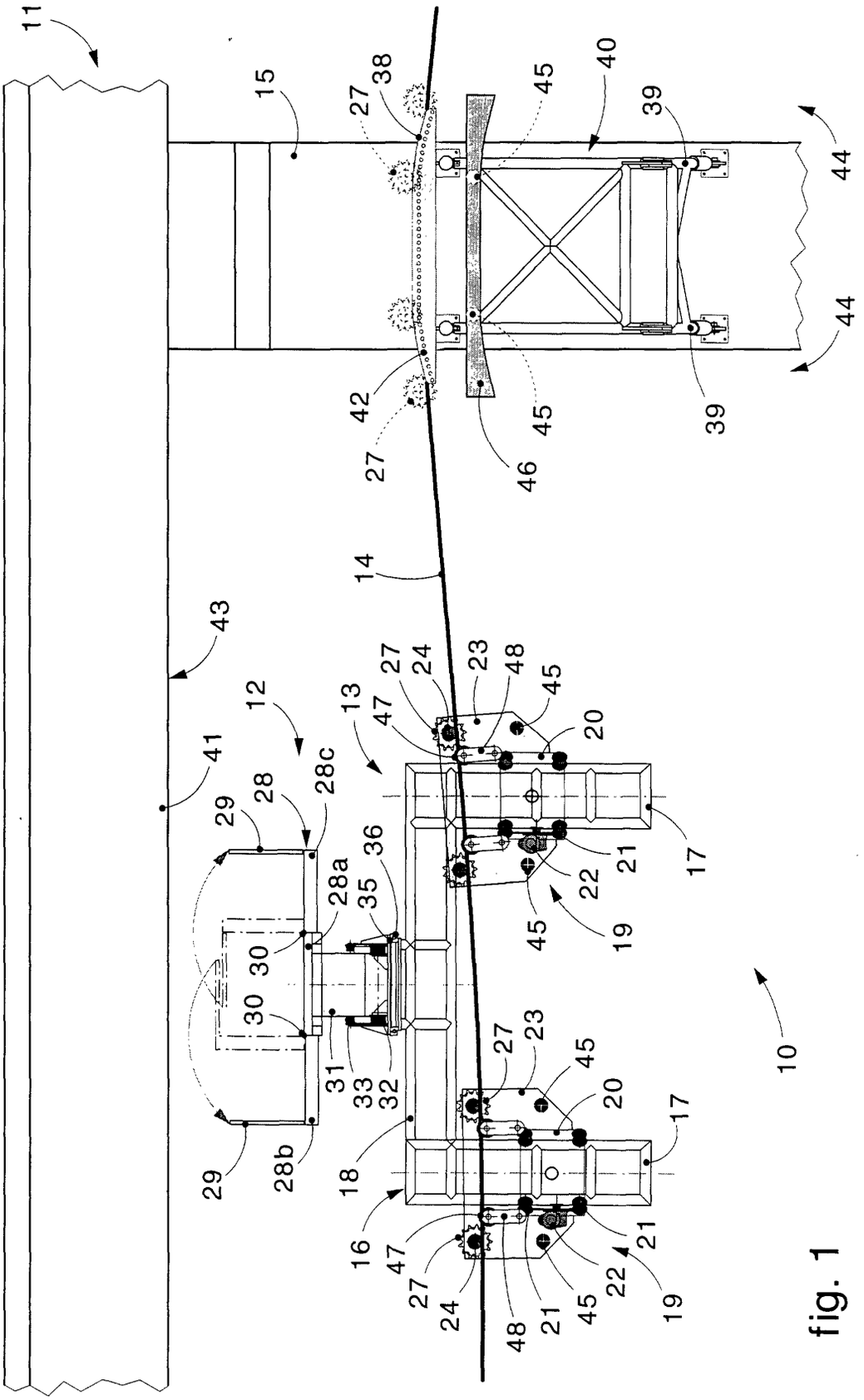
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fig. 1

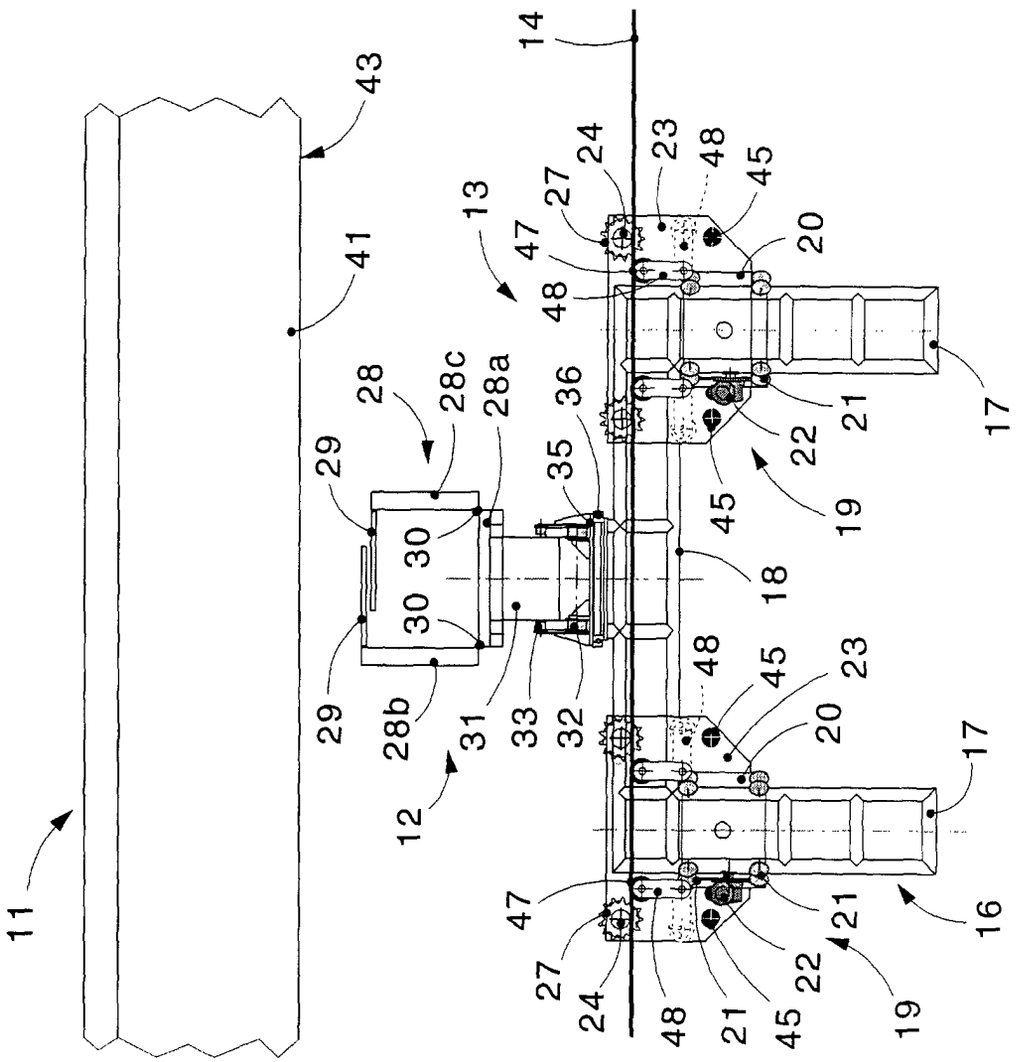
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fig. 2

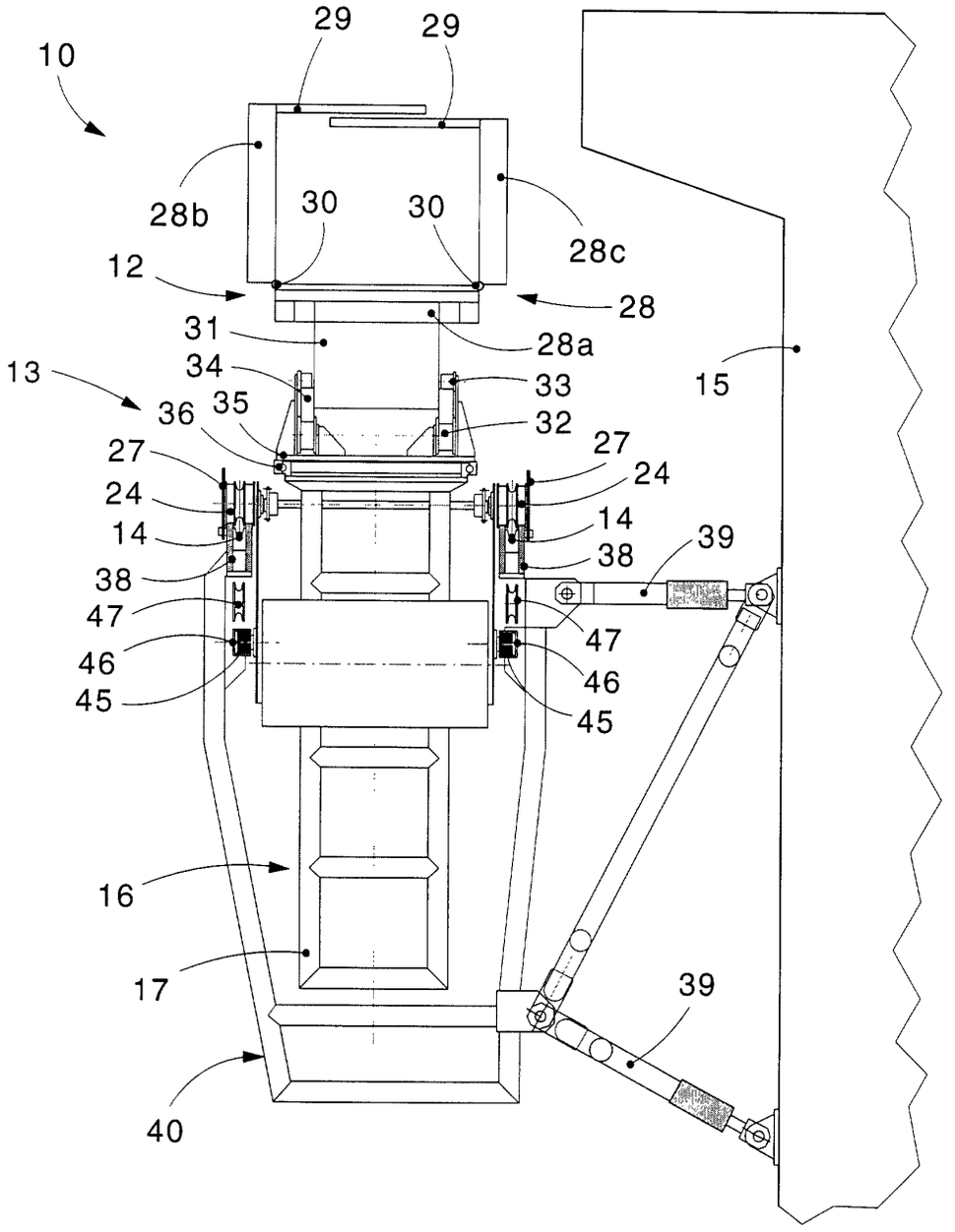
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fig. 3

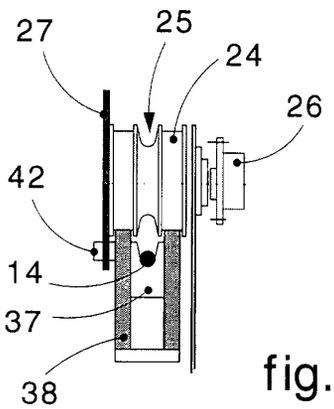
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fig. 4

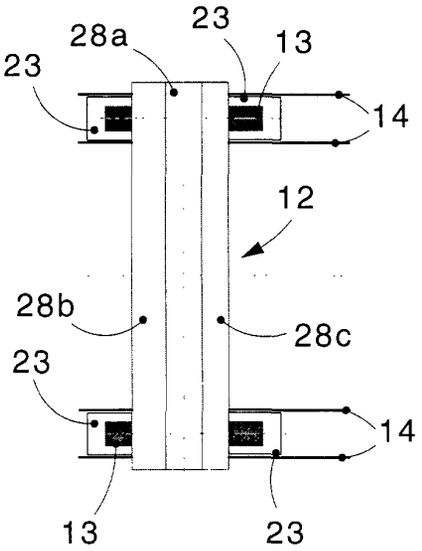

fig. 5

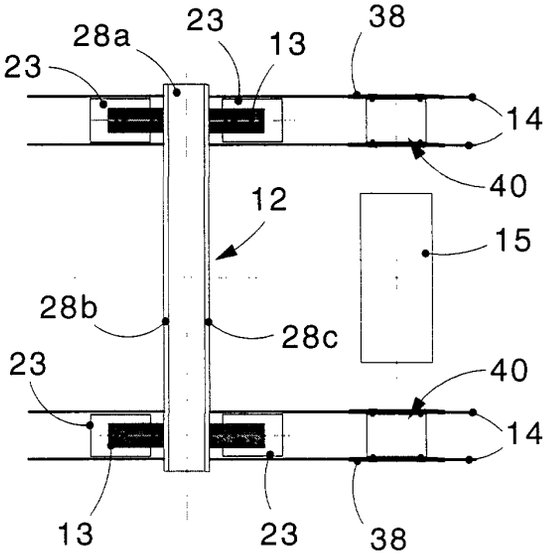

fig. 6

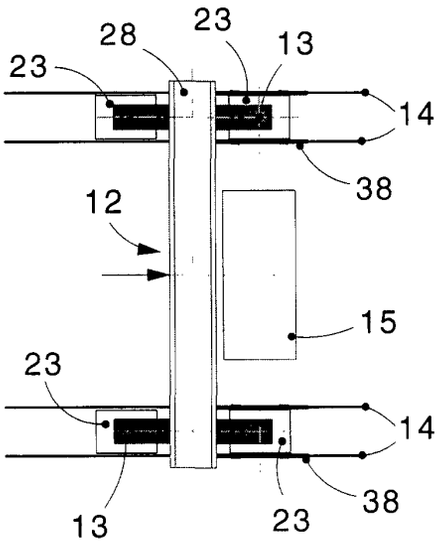

fig. 7

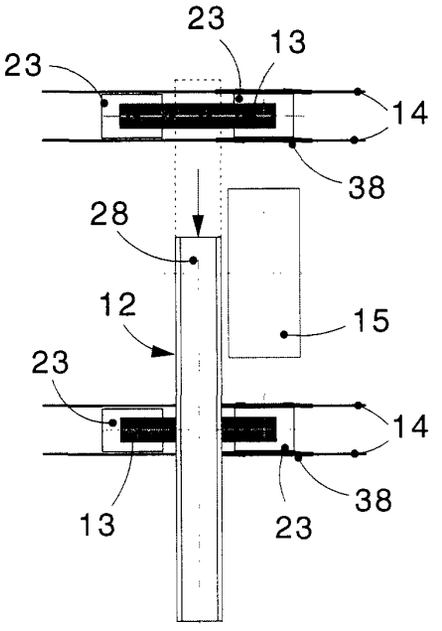

fig. 8

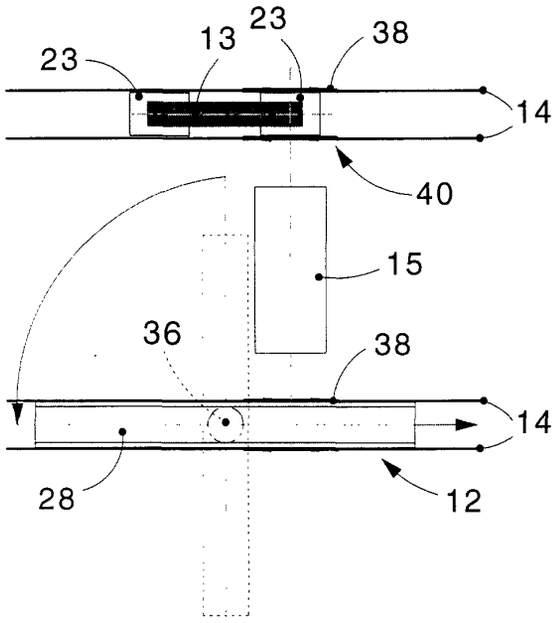

fig. 9

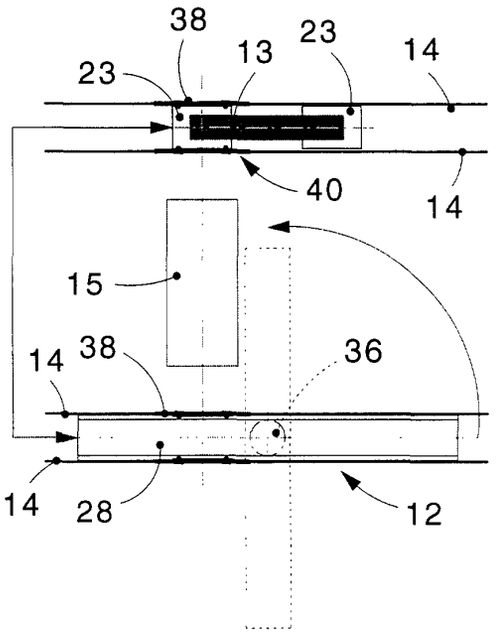

fig. 10

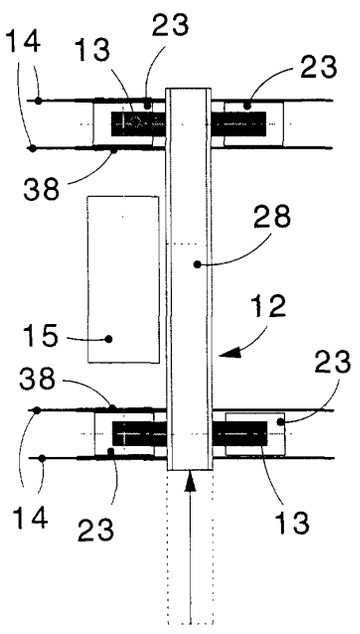

fig. 11

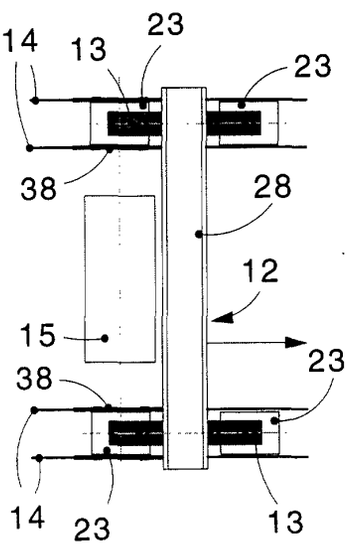

fig. 12

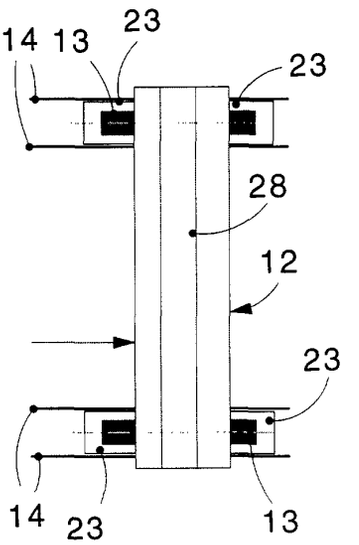

fig. 13