(19) Europäisches Patentamt
European Patent Office
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(11) **EP 4 159 975 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.04.2023 Bulletin 2023/14

(21) Application number: **22199018.7**

(22) Date of filing: **30.09.2022**

(51) International Patent Classification (IPC):
E21D 11/10 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E21D 11/102

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **01.10.2021 IT 202100025274**

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(54) **EQUIPMENT FOR SUPPORTING AND MOVING FORMWORKS FOR BUILDING TUNNELS**

(57) The invention relates to equipment for supporting and moving formworks for producing tunnels, comprising at least one pair of supports (10) provided with rolling means (40) and a frame (50) mounted on said supports, wherein each support comprises a body (11) that includes a first chamber (12), in which there is slidably housed a first piston (16) with a first rod (17) connected to the frame, a second chamber (13), in which there is slidably housed a second piston (18) with a second rod (19), and a supporting element connected to the end of the second rod, wherein the first and the second pistons are coaxial and the respective rods extend from the body in opposite directions, wherein the second piston is movable between a retracted position, in which the rolling means of the support are in contact with the ground and the supporting element is raised, and an extended position, in which said rolling means are raised and the supporting element is in contact with the ground.

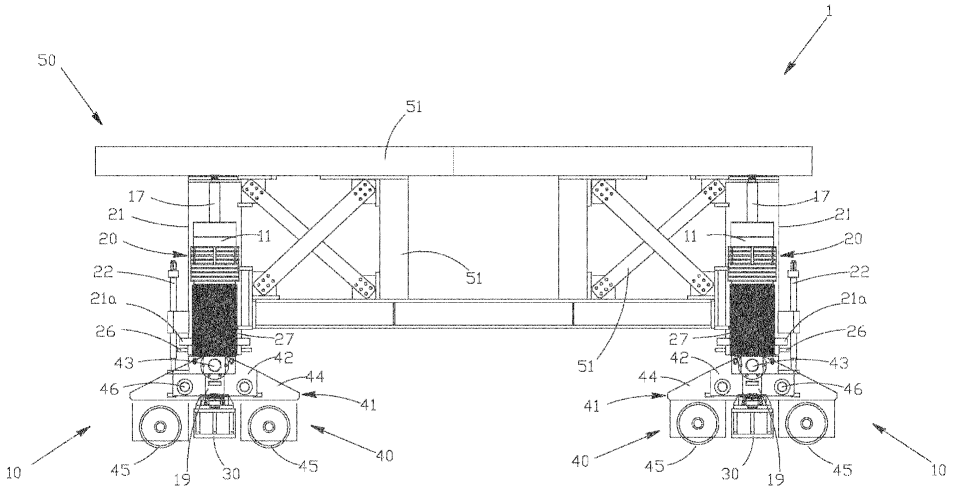


Fig.1

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Description

[0001] The present invention concerns equipment for supporting and moving formworks, in particular for producing the internal lining of tunnels.

[0002] More in detail, the invention relates to equipment configured to move the formworks along the excavation to produce the various sections of the internal lining but also to support said formworks during casting, i.e., to receive and transfer to the ground the entire load generated by the pressure of the concrete casting on the formworks.

[0003] As is known, the internal lining layer of tunnels is produced using formworks that reproduce the internal surface of the tunnel. These formworks comprise panels placed side by side with one another in radial or transverse direction with respect to the direction of extension or axis of the tunnel.

[0004] As the length of the formworks in the direction of the axis of the tunnel is limited, generally from 6 m to 12 m, the internal lining is formed by several contiguous sections produced one after another. After the casting of a section has been completed, the formworks are then moved along the tunnel to produce the next section.

[0005] Various types of formworks and related equipment that allow their movement along the tunnel are known in the state of the art.

[0006] A first type of "conventional" equipment comprises a gantry structure provided with wheels that can move along guides or tracks fixed to the ground. A supporting frame, which supports the various sections of formworks that form the vault portion of the tunnel to be cast, is mounted on said gantry structure.

[0007] The load generated by the concrete casting is transferred from the formworks to the frame and from the latter to the gantry structure, which therefore acts as load-bearing structural element.

[0008] Examples of equipment of this type are described, for example, in EP 3309358 B1, EP 1096105 A2, EP 1136650 A1 and WO 2014/180841 A2.

[0009] Supporting and adjusting devices, known as "wedge formworks", or equivalent means, are used to take the equipment to, and maintain it in, the "forming" position. Through these supporting devices, the load from the structure is transferred to the ground

[0010] However, these supporting and adjusting devices are somewhat impractical both to maneuver and to move. In fact, the drive for the forming and stripping operations is generally of manual type and requires the use of large spanners.

[0011] Moreover, these devices weigh several tens of kilograms, making considerable efforts necessary both for their movement on the site and for correct positioning under the gantry structure.

[0012] Finally, these devices are subject to jamming and therefore require frequent cleaning and maintenance operations.

[0013] Equipment called "self-supporting formworks" are also known and widely used in the field. This equipment is "made to measure" for a given work to be built and generally comprises a support structure, called "formwork carrying tower" to which the various formwork sections are connected. This equipment is provided with hydraulic devices to move the formwork sections between the forming and stripping positions.

[0014] Examples of equipment of this kind are, for example, described in DE 102004060653 A1 and ES 1144986 U.

[0015] Unlike conventional structures, self-supporting formworks are configured to work "in an arch", i.e., so that the loads caused by casting are transferred to the ground, while the support structure acts only as supporting element during movement of the equipment along the tunnel.

[0016] For this reason, equipment of this type also requires the use of wedge formworks, or equivalent devices, placed at the ends of the wing formworks, with the same drawbacks described above.

[0017] Structures conceptually similar to self-supporting formworks are "self-reacting formworks". Unlike the two types described previously, equipment of this kind has a structure that does not require anchoring of the wing formworks, However, self-reacting formworks also require the use of wedge formworks arranged under the wing formworks for the operations of forming and stripping of the equipment.

[0018] In this context, the object of the present invention is to provide equipment for supporting and moving formworks that overcomes the limits of the prior art.

[0019] In detail, the object of the present invention is to produce equipment for supporting and moving formworks that allows the positioning operations and the forming and stripping maneuvers to be carried out in a simple, rapid and safe manner for the operators.

[0020] In particular, the object of the present invention is to produce automated equipment that does not require manual intervention by the operator during the steps to adjust the position the formworks and forming and stripping thereof.

[0021] A further object of the present invention is to provide equipment for supporting and moving formworks that allows the compensation of any deformations or subsidence of the ground, of the structure or of the formworks, caused by the force of the concrete casting.

[0022] These objects are achieved by equipment for supporting and moving formworks destined for building tunnels, in conformity with claim 1.

[0023] In detail, according to the invention, said equipment comprises at least one pair of supports provided with rolling means and a frame, mounted on said supports, adapted to support one or more formworks.

[0024] According to a typical embodiment, two equipment according to the invention are used to support a gantry structure movable along the tunnel and on which the formworks are installed. Each of the two equipment according to the invention is therefore positioned under

the uprights of said gantry structure to form a movable formwork.

[0025] According to a first aspect of the invention, each support comprises a body that includes a first chamber and a second chamber, in which there are respectively slidably housed a first piston, integral with a first rod and a second piston, integral with a second rod. The end of the first rod is fixed to the frame, while the end of the second rod is connected to a supporting element adapted to come into contact with the ground.

[0026] The first chamber and the second chamber can be supplied with a pressurized hydraulic fluid to control the movement of the respective pistons along a substantially vertical axis.

[0027] In the description below, the terms vertical, horizontal, above and below refer to the operating configuration of the equipment, as represented in the accompanying figures described below.

[0028] According to an aspect of the invention, the rolling elements are fixed to the body of the support, preferably at the lower end of said part.

[0029] According to the invention, the first piston and the second piston are coaxial and the respective rods extend from the body in opposite directions.

[0030] The two chambers in the body are not communicating and therefore the movements of the respective pistons are independent.

[0031] In practice, the body, the two pistons and the respective rods form as a whole a double hydraulic actuator that acts along the same axis.

[0032] According to the invention, the second piston is movable between a retracted position, in which the rolling means of the support are in contact with the ground and the supporting element is raised, and an extended position, in which said rolling means are raised and the supporting element is in contact with the ground.

[0033] In general, the first pistons of the supports have a longer stroke and provide a total thrust that is sufficient to support the weight of the gantry structure positioned above and of the various formworks. Therefore, the first pistons can be used to move the structure vertically from the transport position, in which the formworks are lowered by a few tens of centimeters with respect to the vault of the tunnel, to a position close to the forming position, and vice versa.

[0034] Instead, the second pistons have a shorter stroke and provide a total thrust that is capable of supporting, in addition to the weight of the entire structure above, also the thrust exerted by the casting.

[0035] Said second pistons are thus destined to receive the load that weighs on the formworks during casting and to transfer it to the ground and are used for fine adjustment of the forming position of the formworks.

[0036] In practice, the second pistons perform the function of the wedge formworks of conventional systems.

[0037] When the second pistons are in the retracted position, the rolling means are resting on the ground, typically on guides, so as to allow the entire structure to be moved along the tunnel.

[0038] Instead, in the extended position, the rod of the second piston brings the supporting element into contact with the ground, raising the equipment and spacing the rolling means from the ground by a few centimeters.

[0039] According to an aspect of the invention, the first piston has a stroke typically between 300 mm and 1000 mm, while the second piston has a stroke typically between 100 mm and 150 mm.

[0040] Nonetheless, these values can vary as a function of the dimensions of the tunnel.

[0041] In general, the ratio between the stroke of the first piston and that of the second piston is between 2 and 10.

[0042] The thrust supplied by the first piston and by the second piston also depends both on the dimensions and weight of the formworks and of the gantry structure and on the number of supports, and hence pistons, that the equipment is provided with.

[0043] According to an embodiment in which two equipment are provided, each having two supports, the first pistons supply a thrust generally between 250 kN and 500 kN, while the second pistons supply a thrust generally between 2500 kN and 3000 kN.

[0044] According to an alternative embodiment, the first pistons can have a shorter stroke and a dimension such as to allow them to support both the weight of the entire structure above and the thrust exerted by casting, while the second pistons can have a longer stroke, which allows the structure and the formworks to be moved between the transport position and the forming position, and vice versa.

[0045] According to an aspect of the invention, the body of the support is mounted sliding on or in a guide element integral with the frame.

[0046] According to a preferred embodiment, said guide element comprises a tube open at least at the lower end in which the body is housed. Preferably, the body of the support and the guide element have a circular plan section, i.e., both have a substantially cylindrical shape.

[0047] Said guide element, besides guiding sliding of the body, also acts as structural element through which the load is transferred from the frame.

[0048] In fact, as the entire weight of the structure above and the thrust of the concrete casting weigh on the supports, the first pistons are generally provided with a mechanical locking device adapted to unload the first pistons and to transfer the load from the frame only to the second pistons.

[0049] According to an embodiment of the invention, the locking device comprises a threaded ring nut, which can be screwed onto a threaded section of the body, adapted to abut against an abutment area of the guide element, preferably a lower end edge of said guide element.

[0050] When the first pistons have moved (raised) the entire gantry structure and the formworks to a position close to the casting position, the ring nut is screwed onto

the body until it abuts against the abutment area of the guide element.

[0051] From this condition, the final forming position of the formworks can be adjusted by operating the second pistons so as to raise the rolling means from the ground.

[0052] Optionally, the forming procedure can be carried out in reverse, i.e., operating the second pistons first, until the rolling means are raised off the ground, and then the first pistons, to raise the whole structure.

[0053] According to another aspect of the invention, the locking device comprises a sensor adapted to detect the contact or proximity of the ring nut with the abutment area of the guide element. In this way, it is possible to verify whether the locking device is effectively operating, i.e. whether the first pistons are "unloaded", before casting the concrete.

[0054] According to another aspect of the invention, a centering element is interposed between the rod of the second piston and the supporting element. Said centering element allows compensation of any misalignments between the rod of the second piston and the supporting element, for example due to the position of said supporting element when it is in contact with the ground, eliminating or reducing any lateral forces that could weigh on the second rod.

[0055] Said centering element can, for example, comprise a conical or partially spherical female seat adapted to accommodate a conical or partially spherical male terminal, said female seat and said male terminal being fitted respectively to the supporting element and to the end of the second rod, or vice versa.

[0056] According to another aspect of the invention, the rolling elements comprise at least one pair of wheels aligned along a direction of movement, which is substantially parallel to the axis of extension of the tunnel when the equipment is in use. Said wheels are pivoted on a supporting bracket connected to the lower end of the guide element.

[0057] Alternatively, the rolling means can comprise rollers, arrays of rollers or tracks, again mounted on the bracket connected to the lower end of the guide element.

[0058] According to an embodiment of the present invention, said bracket is connected to the lower end of the body so as to rotate about an axis substantially horizontal and transverse to the direction of travel of the rolling means. The bracket can thus swivel slightly with respect to the body of the support to compensate variations in the inclination of the ground on which the wheels rest.

[0059] According to a preferred variant, said bracket comprises a first portion, rotatably connected to the body, and a second portion, mounted sliding on the first portion along a transverse direction, i.e., parallel to the axis of rotation of the first portion, on which the wheels are pivoted.

[0060] The lateral movement of the second portion allows the transverse position of the structure to be adjusted so as to ensure centering of the formworks with respect to the casting to be performed. Preferably, an actuator, for example a hydraulic or electric actuator, is provided, adapted to control the transverse movement of the second portion of the bracket with respect to the first.

[0061] According to another aspect of the invention, the equipment can comprise a sensor adapted to measure the movement (sliding) of the body of the support with respect to the guide element, i.e., indirectly, the stroke of the first piston. Said sensor is preferably a linear transducer with two mutually sliding parts, fixed respectively to the lower end of the body, or optionally to the bracket that supports the wheels, and to the guide element.

[0062] According to another aspect of the invention, the equipment can comprise a further sensor adapted to detect the movement of the second piston in the second chamber. According to a preferred embodiment, said sensor is housed inside the rod of the piston. Said sensor is preferably a linear and proximity sensor.

[0063] According to an aspect of the invention, the equipment is provided with a hydraulic circuit that allows control of the passage of a hydraulic fluid into and out of the first chamber and the second chamber, for movement of the pistons.

[0064] This hydraulic circuit is managed by a control unit, such as a PLC or an equivalent computerized device.

[0065] Preferably, each first or second piston can be controlled separately from the others by means of solenoid valves or other equivalent control means.

[0066] Moreover, said control unit is connected to the various sensors with which the equipment is provided.

[0067] According to another aspect of the invention, the equipment can comprise load sensors adapted to detect the load that weighs on the support, especially during the casting step.

[0068] According to this variant, the control unit is configured to receive the data measured by said load sensors and to control the hydraulic circuit, for example the solenoid valves and/or the fluid pumping means, in order to operate one or more of the second pistons.

[0069] In this way, it is possible to compensate any subsidence of the ground under the supporting elements or excessive deformations of the formworks or of the structure.

[0070] Said load sensors can, for example, be load cells, pressure sensors on the hydraulic circuit that supplies the chambers, or similar.

[0071] According to another aspect of the invention, the equipment can be provided with further sensors adapted to detect the position and/or the orientation of the formworks. According to this variant, the control unit can be configured to receive the data measured by the aforesaid sensors and to control the hydraulic circuit in order to operate the pistons (the first or the second or both) in a coordinated manner and thus automatically control the movement of the formworks, especially from the transport position toward the forming position.

[0072] In practice, the equipment thus configured al-

lows management of the final forming position of the formworks (height, lateral and frontal inclination) in a completely automatic way.

[0073] Further features and advantages of the present invention will be more apparent from the description of a preferred, but not exclusive, example of embodiment of equipment for supporting and moving formworks, as illustrated in the accompanying figures, wherein:

- Fig. 1 is a front view of the equipment according to the present invention;
- Fig. 2 is a side view of the equipment of Fig. 1;
- Fig. 3 is a sectional view along a vertical plane of a support of the equipment according to the present invention;
- Figs. 4a and 4b illustrate details of the support of the equipment according to the present invention;
- Figs. 5a, 5b a 7a, 7b are respectively sectional front and side views of a structure for the movement of formworks provided with the equipment according to the present invention, during some steps of use in a tunnel.

[0074] With reference to the accompanying Figs. 1 and 2, the number 1 indicates as a whole the equipment according to the present invention, which comprises two supports 10 on which a frame 50 is mounted.

[0075] As mentioned above, the equipment can be used for supporting and moving a support structure 100, on top of which the formworks 110, adapted to receive the concrete casting to produce the internal lining of the tunnel, are carried (Figs. 5-7).

[0076] The frame 50 comprises one or more elements 51, for example beams, poles or the like, rigidly joined to one another, which, as a whole, connect the two supports 10 and keep them spaced from and parallel to each other. The frame is typically made of steel or other metals with suitable mechanical strength.

[0077] It must be noted that the shape of the frame 50 represented in the figures is merely an example and that any other structural configuration suitable to support the weight of the structure 100 and the loads of the casting transferred to formworks 110 can be adopted.

[0078] Each of the supports 10 comprises a body 11, substantially cylindrical in shape, slidably housed in a guide element 20 fixed rigidly to the frame 50. Said guide element 20 comprises a cylindrical tube 21 open at the lower end.

[0079] A first chamber 12 and a second chamber 13 are produced in the body 11. The chambers 12, 13 are cylindrical cavities that flow out at the respective ends of the body. Two covers 14, 15 close the first chamber 12 and the second chamber 13, respectively. In the first chamber 12 there is slidably housed a first piston 16 connected to a first rod 17 mounted sliding in an opening 14a of the cover 14.

[0080] In the second chamber 13 there is slidably housed a second piston 18 connected to a second rod 19 mounted sliding in an opening 15a of the cover 15.

[0081] The axes of the pistons 16, 18 and of the related rods 17, 19 are all coincident and marked with Y in the figures.

[0082] The free end of the first rod 17, which extends upward from the body 11, is fixed to the upper side of the guide element 20 and therefore it is also integral with the frame 50.

[0083] The free end of the second rod 19, which extends downward from said body 10, is connected to a supporting element 30.

[0084] The support is further provided with rolling means 40 connected to the lower end of the body 10, more precisely to the cover 15 that closes the second chamber 13.

[0085] According to the variant illustrated in the figures, the rolling means 40 comprise a bracket 41 that includes a first portion 42 hinged on the cover 15 by means of a pin 43 so as to be able to swivel about a substantially horizontal axis X2. Said first portion 42 of the bracket 41 supports a second portion 44 mounted on the first portion 42 sliding along a direction parallel to the axis X2. At least one pair of wheels 45, aligned along the direction of translation X1 of the equipment along the tunnel, are mounted on the second portion 44.

[0086] According to an embodiment, the first portion 42 comprises a pair of plates 42a positioned between which are one or more sliding guides 46 connected to the second portion 44. Preferably, said sliding guides 46 are associated, or are integrated, with respective hydraulic, electric or similar actuators, which allow automatic adjustment of the position of the structure 100 with respect to guides or tracks on the ground.

[0087] The first portion 42 and the second portion 44 of the rolling means 40 are shaped so as to have a central housing 47 communicating with the lower end of the body 11, through which the second rod 19 of the second piston 18 can extend and which, in the completely retracted position of the second piston 18, allows the supporting element 30 to remain raised with respect to the bearing plane of the wheels 45.

[0088] The supporting element 30 is preferably in the shape of an arch or a "saddle" so that, when it is resting on the ground, it can remain substantially aligned with the tracks or the guides on which the wheels 45 run.

[0089] According to a preferred variant, the free end of the second rod 19 and the supporting element 30 are connected by a centering element 32 which comprises a female seat 33, fixed on the upper part of the supporting element 30, adapted to accommodate a male terminal 34, fixed to the end of the second rod 19.

[0090] According to a preferred variant, the female seat 33 has a partially conical or partially spherical shape and the male terminal 34 has a partially conical or partially spherical shape complementary to the shape of the female seat 33.

[0091] The centering element 32 thus structured allows limited deviations and/or rotations between the sec-

ond rod 19 and the supporting element 30. In this way the second rod 19, and the support 10 as a whole, can maintain a substantially vertical position regardless of the orientation of the supporting element 30 in the section of ground on which it rests. Moreover, thanks to the centering element 32, lateral or bending forces on the second rod, which could occur due to the arrangement of the supporting element 30 on the ground, are prevented or limited.

[0092] A mechanical locking device 25 comprising a threaded ring nut 26, which can be screwed onto a respective threaded portion 27 produced on a lower end section of the body 11, is provided at the lower end 11a of the body 11.

[0093] Said ring nut 26 is adapted to abut against an abutment area at the lower end 21a of the tube 21 of the guide element 20.

[0094] In this way, the load is transferred from the frame 50 directly to the body 11 leaving the first pistons 16 and the related rods 17 substantially unloaded.

[0095] Preferably, a sensor, not illustrated in the figure, is arranged on said tube 21, adapted to detect the contact or proximity of the ring nut 26 with the abutment area of the guide element 20. Said sensor is preferably a proximity sensor.

[0096] The position and movement of the first piston 16 are measured preferably by means of a linear transducer 22 comprising two mutually sliding parts 23, 24, respectively fixed to the lower cover 15 and tube 21 of the guide element 20. This transducer thus detects the movement of the body 11 with respect to the frame 50, i.e., when the rolling means 40 are resting on the ground, the vertical movement of the frame 50 with respect to the ground.

[0097] Figs. 5a, 5b a 7a, 7b illustrate a structure 100 for moving formworks 110 provided with the equipment 1 according to the present invention.

[0098] In detail, in the aforesaid figures the structure 100 is represented in different steps during its use in a tunnel G.

[0099] In Figs. 5a, 5b the structure 100 and the related formworks 110 are in forming position; the structure is thus in raised position so that the outer surface of the formworks 110 is substantially coincident with the internal surface of the lining R of the tunnel G. With particular reference to Figs. 5a, 5b the casting step has already been carried out and the lining section R has already been formed.

[0100] In this forming position, the first pistons 16 are extended so that the body 11 protrudes at least partly beyond the lower end 21a of the tube 21 of the guide element 20. Moreover, the end 21a of the tube 21 is abutting against the threaded ring nut 26 so that the load is transferred from the frame 50 to the body 11, unloading the first pistons 16.

[0101] In the forming position represented in Figs. 5a, 5b the second pistons 18 are also extended so that the supporting element 30 is in contact with the ground and the wheels 45 are spaced from the tracks 120 by a few tens of millimeter.

[0102] The entire load weighing on the frame 50 is thus transferred to the ground from the body 11 through the second pistons 18.

[0103] Figs. 6a, 6b illustrate the structure 100 in a first stripping step. In this position, the second pistons 18 are retracted, together with the second rods 19 and with the supporting elements 30, lowering the whole structure 100 by a few millimeters and bringing the wheels 45 into contact with the tracks 120. Moreover, in this position the ring nut 26 is rotated on the thread of the body 11 and is detached from the lower end 21a of the tube 21.

[0104] In a second step of complete stripping, illustrated in Figs. 7a, 7b, the first pistons 16 are retracted lowering the whole structure 100 by a few tens of centimeters. In this position the structure 100 can be moved along the tracks 120 and be repositioned to produce a new section of the lining R of the tunnel G.

[0105] The forming steps of the structure from the completely lowered position are the opposite of the stripping steps described above.

[0106] In detail, when the structure 100 has been repositioned along the axis of the tunnel, initially the first pistons 16 extend to their maximum stroke or to the predetermined extension position, then the ring nut 16 is taken to abut against the lower end 21a of the tube 21 and, finally, the second pistons 18 extend until the supporting elements 30 are brought into contact with the ground and, continuing their extension, the formworks 110 are taken to the final position, their outer surfaces coincide with the ideal internal surface of the lining of the tunnel which is subsequently cast.

[0107] The present invention has been described purely by way of non-limiting illustrative example, according to some preferred embodiments. The person skilled in the art may find numerous other embodiments and variants, all falling within the scope of protection of the appended claims.

Claims

1. Equipment (1) for supporting and moving formworks (110) destined for building tunnels, said equipment comprising:

   - at least one pair of supports (10) provided with rolling means (40); and
   - a frame (50), mounted on said supports (10), adapted to support a structure (100) on which one or more formworks (110) are installed;

   wherein each support (10) comprises a body (11) that includes a first chamber (12), in which there is slidably housed a first piston (16) integral with a first rod (17) connected to the frame (50); **characterized in that** said body (10) further comprises:

- a second chamber (13), in which there is slidably housed a second piston (18) integral with a second rod (19); and
- a supporting element (30) connected to the end of the second rod (19);

wherein the first chamber (12) and the second chamber (13) can be supplied with a pressurized hydraulic fluid to control the movement of the respective pistons (17, 19) along a substantially vertical axis (Y),
wherein the first piston (16) and the second piston (18) are coaxial and the respective rods extend from the body (11) in opposite directions,
wherein the second piston (18) is movable between a retracted position, in which the rolling means (40) of the support (10) are in contact with the ground and the supporting element (30) is raised, and an extended position, in which said rolling means (40) are raised and the supporting element (30) is in contact with the ground.

2. The equipment according to claim 1, wherein the first piston (16) is associated with a mechanical locking device (25).

3. The equipment according to any one of the preceding claims, wherein the body (11) of the support (10) is mounted sliding in a guide element (20) integral with the frame (50).

4. The equipment according to claims 2 and 3, wherein the locking device (25) comprises a threaded ring nut (26), that can be screwed onto a threaded section (27) of the body (11), adapted to abut against an abutment area (21a) of the guide element (20).

5. The equipment according to claim 4, wherein the locking device (25) comprises a sensor adapted to detect the contact or proximity of the ring nut (26) with the abutment area (21a) of the guide element (20).

6. The equipment according to any one of the preceding claims, wherein a centering element (32) is interposed between the rod (19) of the second piston (18) and the supporting element (30).

7. The equipment according to any one of the preceding claims, comprising a sensor adapted to detect the movement of the second piston (18) in the second chamber (13), said sensor being housed inside this chamber or the rod (19) of the piston (18).

8. The equipment according to any one of the preceding claims, comprising a hydraulic circuit for supplying a hydraulic fluid to the first chamber (12) and to the second chamber (13) and a control unit adapted to control said hydraulic circuit.

9. The equipment according to claim 8, comprising load sensors adapted to detect the load that weighs on the support (10) during the casting step, the control unit being configured to receive the data measured by said load sensors, to control the hydraulic circuit and, if necessary, operate one or more of the second pistons (18) to compensate for any subsidence of the ground under the supporting elements (30) or excessive deformations of the formworks (110) or of the structure (100).

10. The equipment according to claim 8 or 9, comprising further sensors adapted to detect the position and/or orientation of the formworks (110), the control unit being configured to receive the data measured by the aforesaid sensors and to control the hydraulic circuit in order to operate the first pistons (16), the second pistons (18), or both, in a coordinated manner, moving the structure (100) and the formworks (110) automatically at least from the transport position toward the forming position.

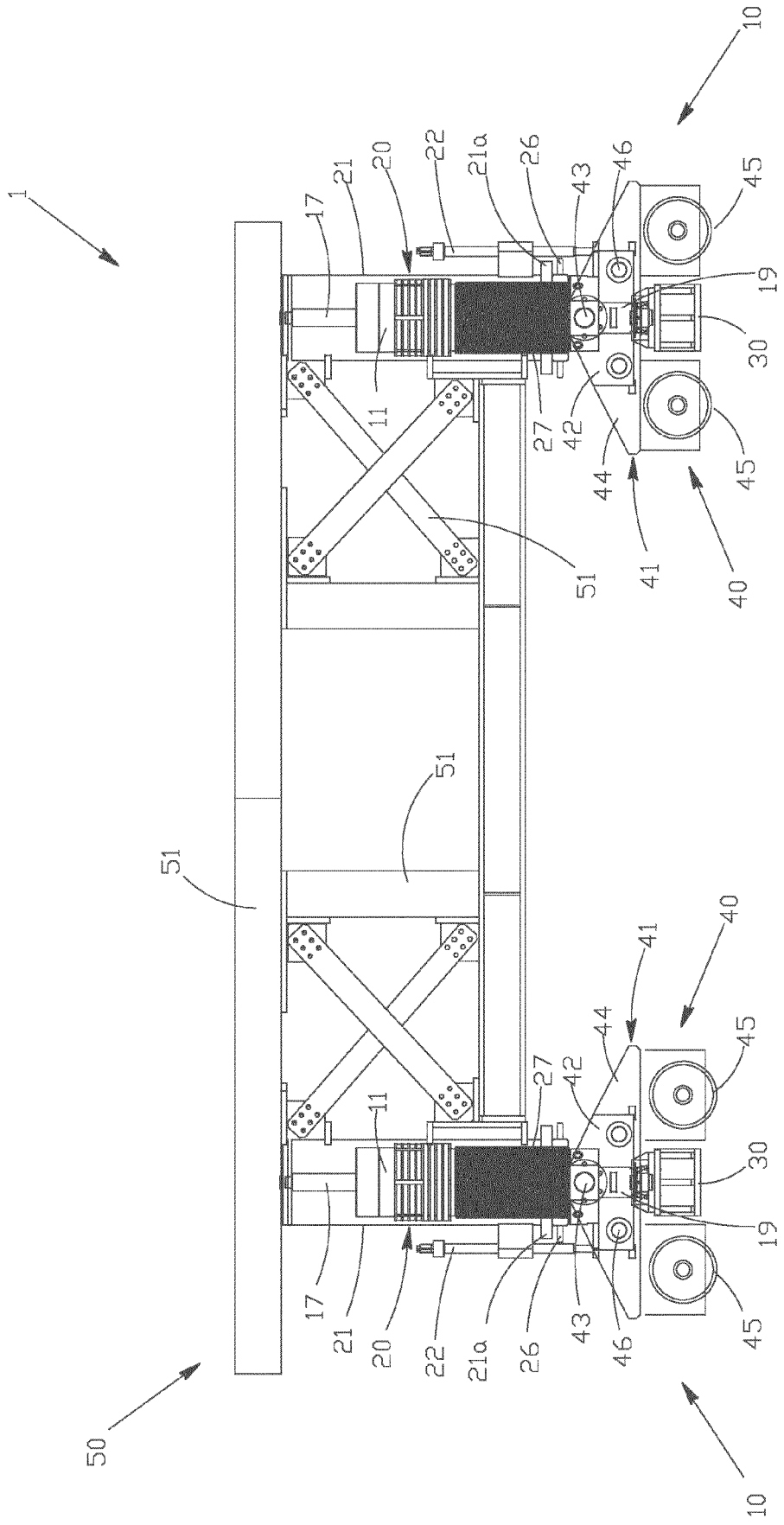


Fig.1

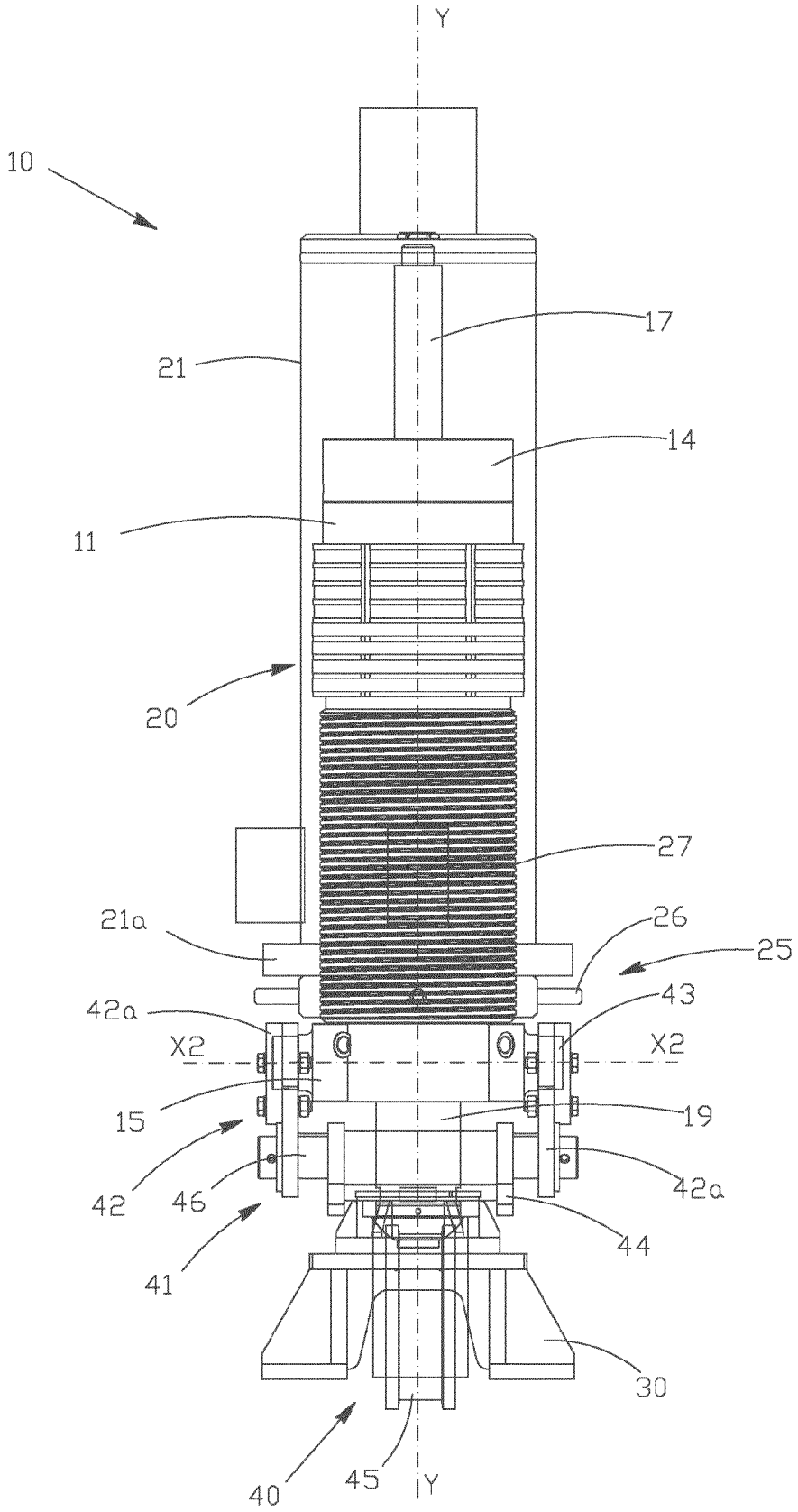

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Fig.2

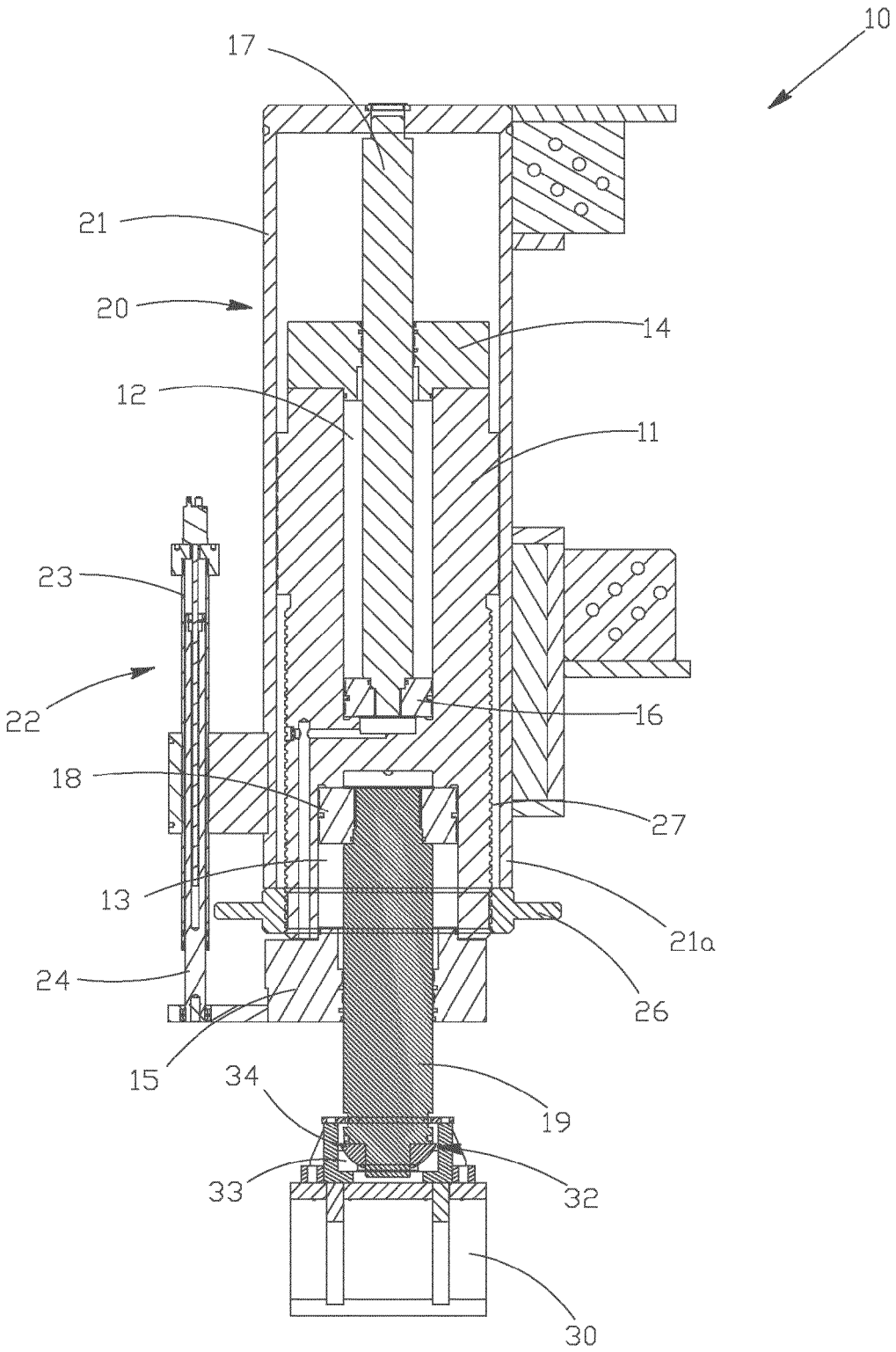


Fig.3

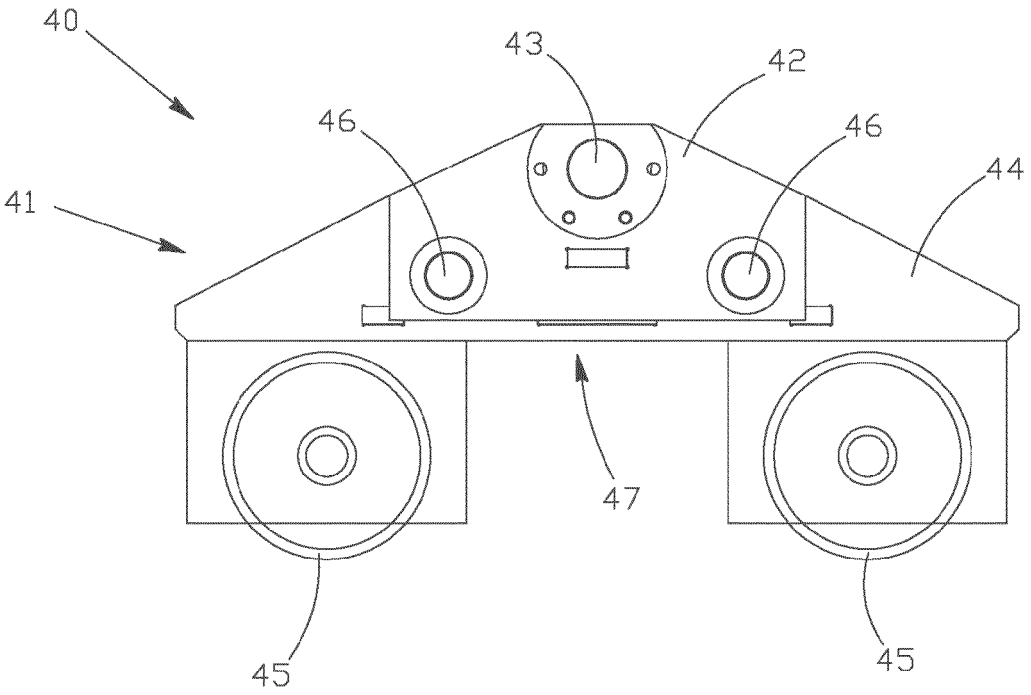


Fig.4a

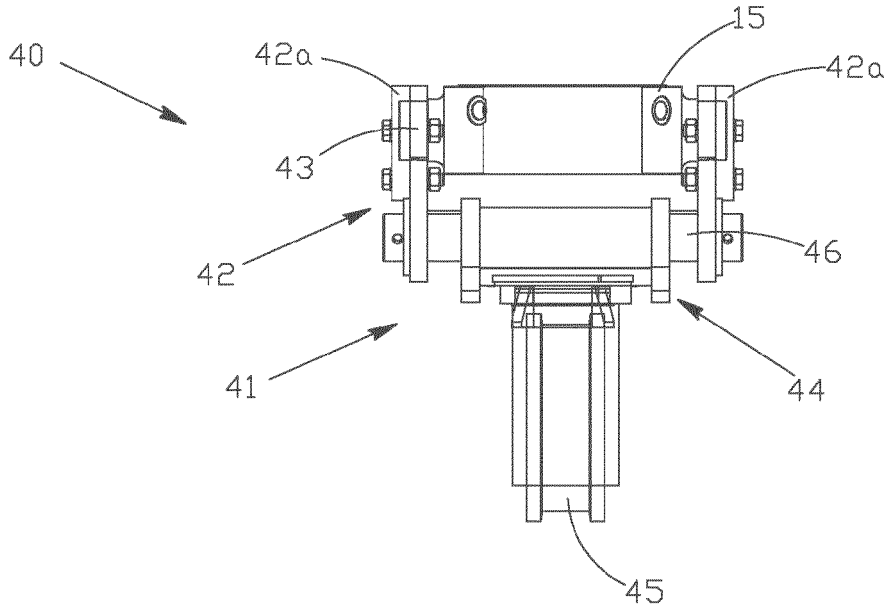


Fig.4b

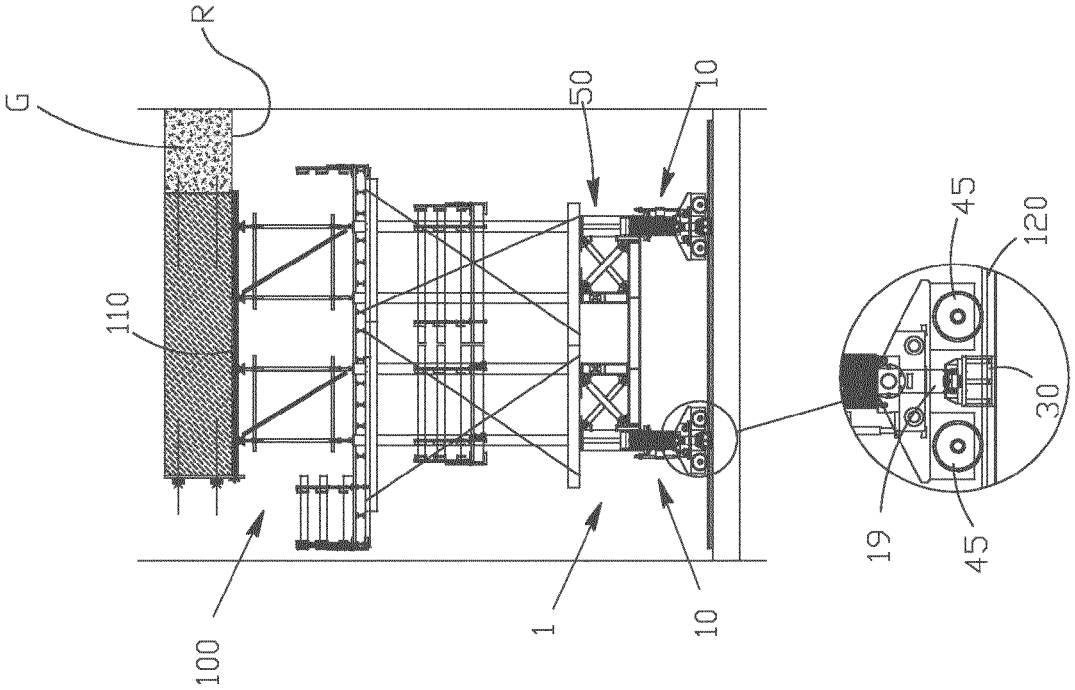

R
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120
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100
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Fig.5b

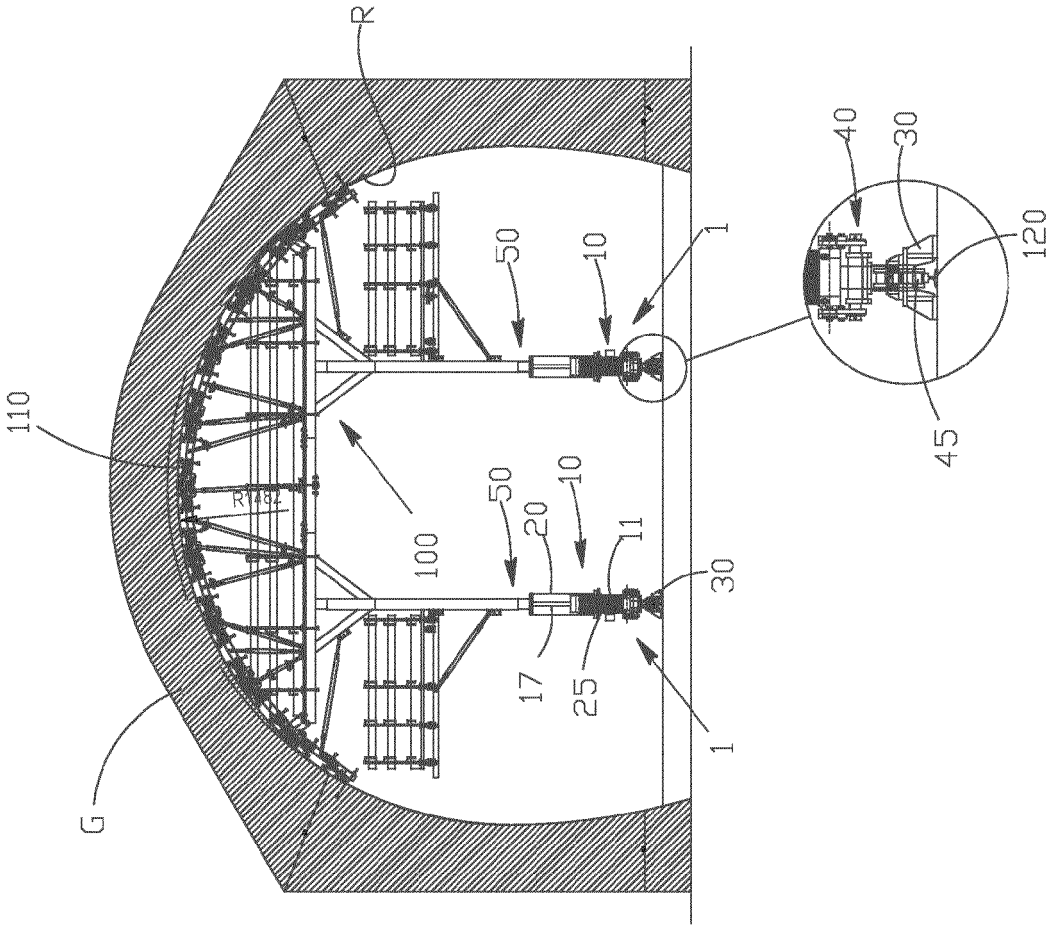

R
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Fig.5a

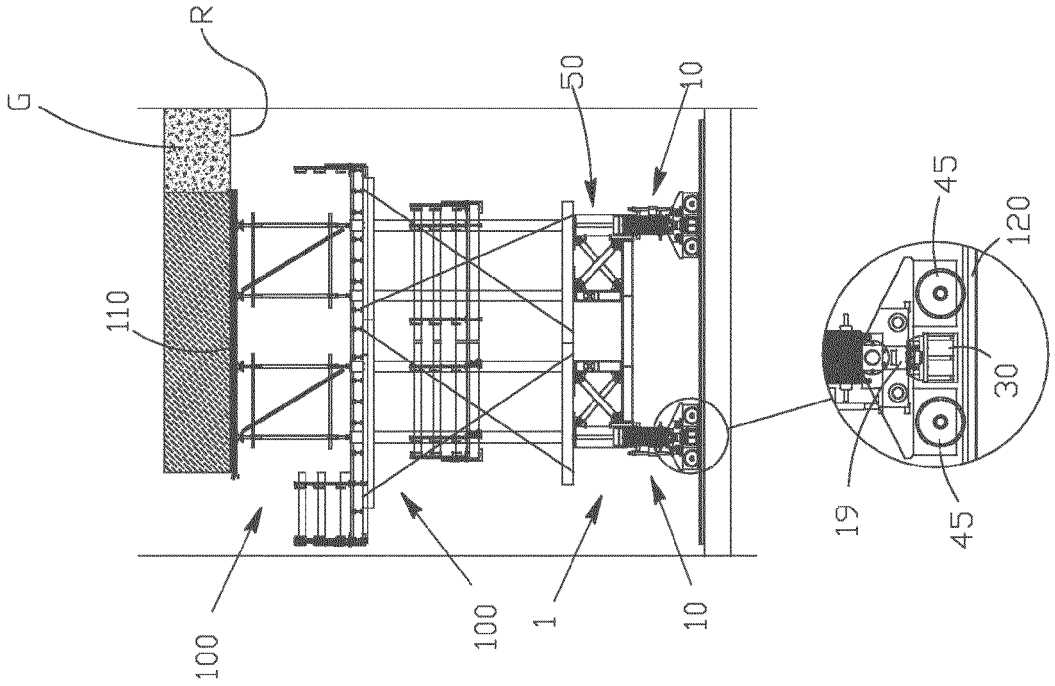

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Fig.6b

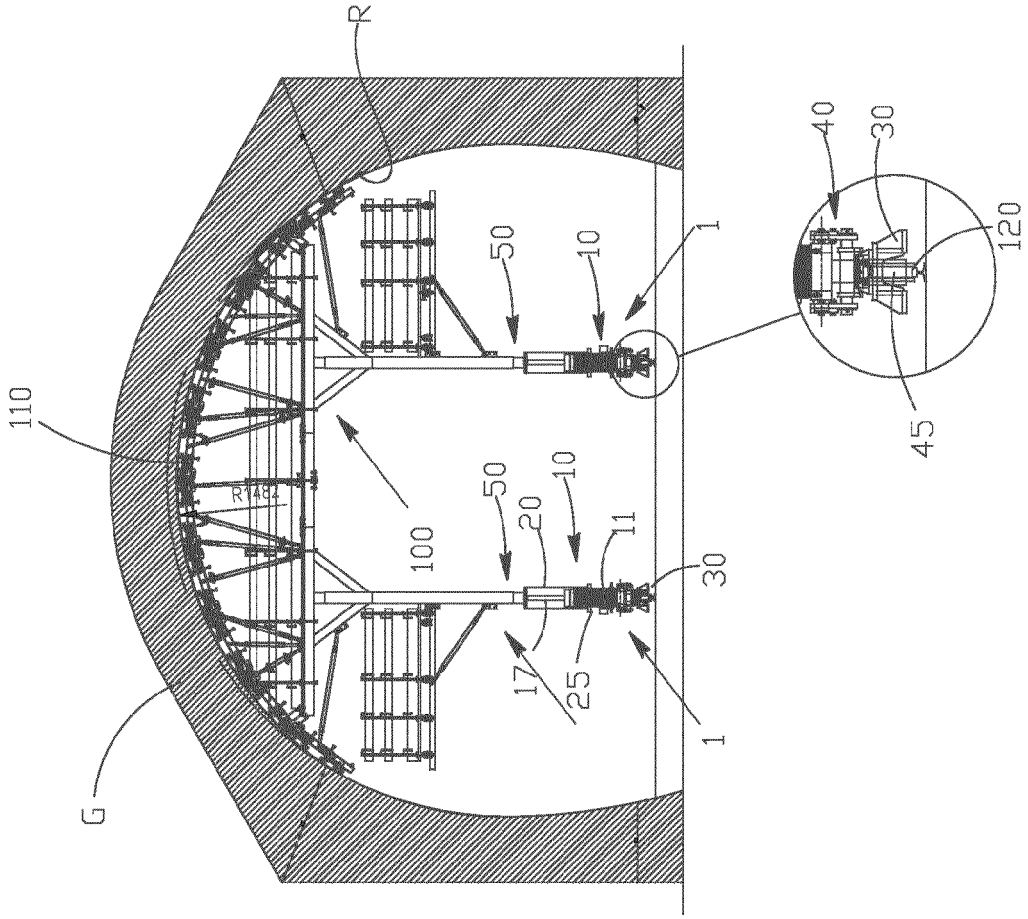

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Fig.6a

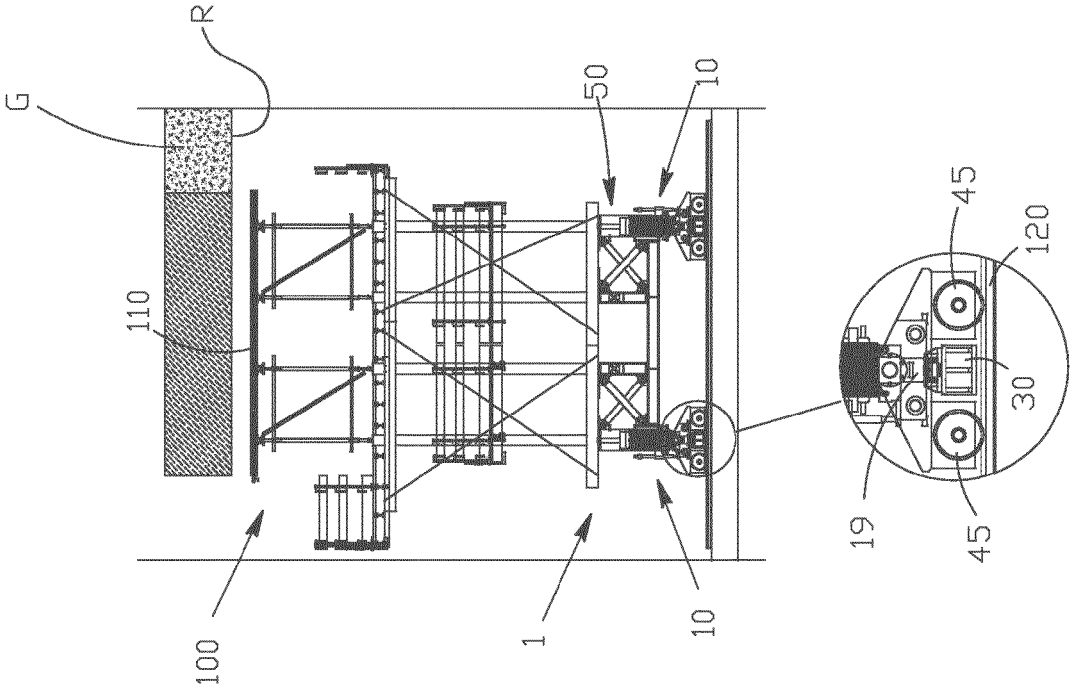

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Fig.7b

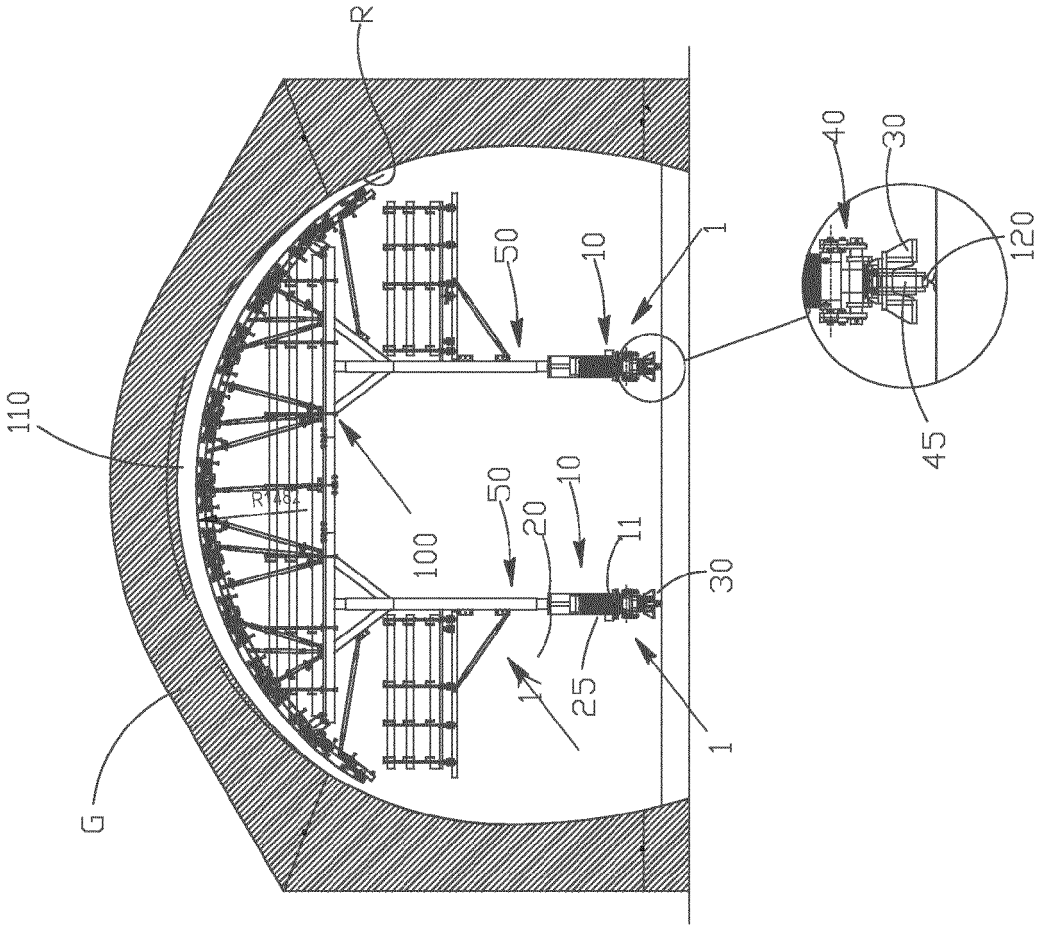

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Fig.7a

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EUROPEAN SEARCH REPORT

Application Number
EP 22 19 9018

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Place of search	Date of completion of the search	Examiner
Munich	1 December 2022	Patrascu, Bogdan

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