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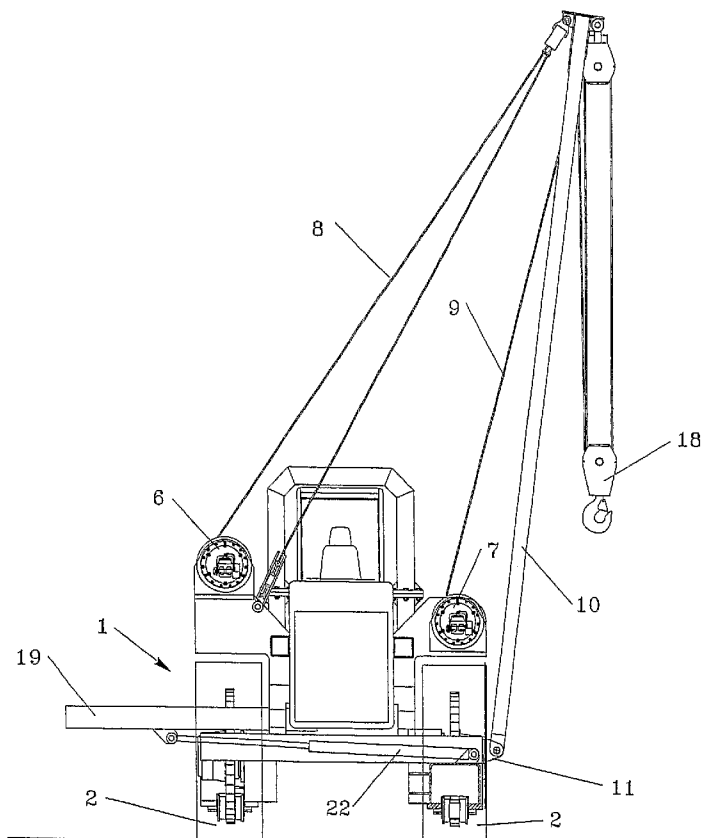
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Declaration under Rule 4.17:

— of inventorship (Rule 4.17(iv))

[Continued on next page]

(54) Title: PIPE-LAYING MACHINE



(57) Abstract: This invention relates to a pipe-laying machine of the type comprising a self-propelled tracked vehicle (1), on one side of which is fitted a crane (10) designed for lifting and laying pipes, which said machine is also fitted with a counterweight constituted by a plate (19) made of a heavy material that moves between a rest position in which it retracts fully into the vehicle and an operational position in which it projects from the vehicle on the opposite side to the crane. In the machine according to the invention, engine unit (3) and control cab (4) are located at each end of chassis (1), projecting slightly from it, to leave a free space in the central part of the vehicle for the installation of all the mechanisms (6, 7) designed for the movement and control of the crane.

**Published:**

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

PIPE-LAYING MACHINE

This invention relates to a perfected pipe-laying machine.

In particular, it relates to a pipe-laying machine consisting of a tracked
5 vehicle to which is removably fitted a crane boom able to lift pipes and the
like and lay them at the bottom of a trench.

The characteristic feature of this invention is that it includes the
counterweight required to balance the moment created by the crane when
it operates in the projecting configuration. Said counterweight consists of a
10 very thick metal (e.g. iron) plate, which is positioned between the tracks of
the vehicle and is subject to the action of means that allow it to be moved
from a rest position in which it retracts fully into the machine and an
operational position in which it projects from the machine to
counterbalance the effect of the loads lifted by the crane.

15 In the machine according to the invention, the engine unit and control cab
are located at each end of the chassis, slightly projecting from it, to leave a
free space in the central part of the vehicle where all the crane movement
and control mechanisms can be installed.

Underground pipes, such as gas and oil pipelines, consist of relatively
20 large, heavy pipe sections, and special machines called pipe-laying
machines are used to lay them.

Said pipe-laying machines, which generally derive from other machines,
such as bulldozers or other common earth-moving machinery, suitably
modified, comprise a tracked chassis driven by an internal combustion
25 engine, to which a crane designed for lifting and moving the pipes is fitted

laterally.

The engine is positioned in the central part of the chassis, behind the cab, and the crane boom is hinged to the crawler track carriage.

This configuration, derived from other machines, restricts the operator's
5 view, which is partly limited by the presence of the engine, and tends to cause a certain imbalance of the machine, which must be compensated by counterweights. Said counterweights are generally installed, in a projecting configuration, on an articulated structure positioned on the opposite side of the machine to the crane.

10 When heavy loads are lifted in a projecting configuration, they are subject to high moments which tend to tilt them from the side where the pipes are lifted. Moreover, as the engine unit and the cab are positioned well above ground level, the centre of gravity of the machine is rather high, with adverse effects on its stability.

15 To overcome this drawback, in addition to using large vehicles which, having a considerable mass, are less subject to the unbalancing effects of the loads lifted, suitable counterweights must be installed on the opposite side of the machine to the crane.

However, this results in a further drawback, as these machines are so
20 large that they cannot be transported by road with normal vehicles; abnormal load transport with an escort is required, making the operation more onerous in financial and organisational terms.

To eliminate these problems, this invention offers a perfected pipe-laying machine comprising a tracked vehicle to which is fitted a boom designed
25 to lift and lay pipes and the like, which said machine is fitted with a

counterweight consisting of a very thick plate made of metal, such as iron, positioned at the same height as the crawler tracks. In particular, said counterweight is installed in a seating in the track-guide carriage, on the opposite side of the machine to the side from which the crane projects,
5 and is subject to the action of means which allow it to be moved from an operational position in which it projects from the machine to a rest position in which it retracts fully into the vehicle.

This system allows the moment created by the loads lifted to be counterbalanced on the opposite side of the machine, thus eliminating the
10 risk of overturning, while keeping the size of the machine within the limits which allow it to be transported by road without the use of special vehicles and/or transport.

Moreover, the engine unit and the cab are located at either end of the chassis. In this way a free space is left in the central part for the
15 installation of the winches and other crane control elements, thus keeping the width of the machine within the limits which allow its transport with no need for special vehicles.

This solution also allows better visibility, during both manoeuvres and pipe movement operations, because the operator has a completely free view
20 on three sides.

This invention also offers an improved system for coupling the boom to the machine, which reduces the width of the machine when the crane boom is removed for road transport purposes.

This invention will now be described in detail, by way of example but not of
25 limitation, by reference to the annexed figures wherein:

- figure 1 is a side view of the perfected pipe-laying machine, in the version with rear cab;
- figure 2 is a front view of the perfected pipe-laying machine, in the version with rear cab;
- 5 • figures 1a and 2a are the side view and front view of the machine respectively, in the version with front cab;
- figures 3a and 3b illustrate the plate that acts as counterweight, in the operational and retracted positions respectively;
- figures 4a and 4b illustrate the structure of the carriage and the crawler
10 tracks with the plate acting as counterweight, seen from the side and from above respectively;
- figures 5a to 5d are four views of the system designed to couple the boom to the track-guide carriage.

In the annexed figures, the pipe-laying machine according to the invention
15 comprises a tracked chassis indicated as 1, driven by a pair of tracks 2, to which an engine unit 3 and a control cab 4 are fitted at the rear and front ends respectively, or vice versa.

The central space thus remains free, and winches 6 and 7, fitted with metal cables 8 and 9 designed to support and move boom 10 of a crane
20 and the associated load, are positioned in it.

This structure, which substantially consists of two tubular units at the upper end, is connected at the lower end to track-guide carriage 5, via connectors 11.

Each of said connectors comprises a plate 12, which presents a ledge 13
25 on one side and is welded or otherwise attached to the structure of the

machine, and a second plate 14 with a shape complementary to plate 12 (in other words also having a ledge 15 on its surface), to which a pair of wings 16, with a hole 17 for the insertion of a hinge pin, is welded.

The lower end of tubular element 10 is positioned between wings 16, and
5 said element is retained in position by the pin inserted in hole 17.

The pins thus form a hinge around which, as a result of the action of winch 6, boom 10 can rotate along an axis parallel to the longitudinal axis of the machine, in order to lift and lay the pipes.

The advantage of this method of connecting the mobile boom is that it
10 limits the width of the machine during transport, when the boom is removed, due to the possibility of removing plate 14 with projecting wings 16.

A pulley with a hook 18, from which the pipes are hung using suitable harnesses not illustrated in the figure, is fitted to the end of said boom 10.

15 The second winch, shown as 15, allows lifting and laying of the pipes.

As already mentioned, the machines according to the prior art present the problem of low stability if no counterweight is fitted, or large size if counterweights are fitted.

To eliminate said problem, this invention uses a counterweight 19
20 consisting of a very thick metal plate (e.g. 20 to 40 cm), inserted in a seating 20 in the track-guide carriage, on the opposite side of the machine to the side where the boom is attached.

Said counterweight can slide in guides with rollers 21 and is subject to the action of means, such as hydraulic cylinders 22, electric motors or the like,
25 which enable it to traverse and move from a rest position in which it

retracts fully into the machine (fig. 3b) to an operating position in which it projects from the contour of the vehicle (fig. 3a).

The function of said counterweight is to counterbalance the moment created by the loads lifted on the opposite side of the machine and to
5 prevent the risk of overturning, especially if, as often happens, the machine operates on slopes or uneven terrain.

The advantage of this system, as well as improving the stability of the vehicle by lowering its centre of gravity due to the particular position of the counterweight, is to make machines which are smaller than the present
10 ones, even though they are fitted with means designed to counteract the tilting moment caused by the crane and its load.

Thus, due to the adoption of the counterweight and the new crane coupling system, the perfected pipe-laying machine can be transported on a trailer with no need for an escort, because its overall dimensions do not
15 exceed those specified in the Highway Code.

A further improvement provided by the invention is that all four wheels (23) that operate the crawler tracks are drive wheels.

This solution is very useful, firstly because these types of machine generally operate on very uneven terrain, e.g. near the edge of a trench,
20 and this method guarantees better traction and better control of the vehicle by the operator, and secondly because the size of the machine is limited.

Four-wheel drive allows the use of much smaller reducers than would be needed to transmit power in the case of two-wheel drive, which would excessively increase the size of the machine.

25 Moreover, whereas in similar known machines the idle wheels keep the

tracks taut, in the machine according to the invention specific tensioning devices are installed, consisting of rocker arms 24 fitted with pairs of rollers 25 and mounted on telescopic supports 26 (fig. 4a) fixed to the carriage.

- 5 The result is a perfected pipe-laying machine which simultaneously presents the advantages of greater stability, smaller size, and easier operation. An expert in the field could devise various modifications and variations, all of which should be deemed to fall within the ambit of this invention, as defined in the annexed claims.

CLAIMS

- 1) Pipe-laying machine of the type comprising a self-propelled vehicle (1), on one side of which is fitted a crane (10) designed for lifting and laying pipes, said machine being characterised in that it includes a counterweight (19) consisting of a plate made of a heavy material, which moves between a rest position in which it retracts fully into the vehicle and an operational position in which it projects from the vehicle on the opposite side to the crane.
- 2) Pipe-laying machine as claimed in claim 1, characterised in that said plate made of heavy material (19) is positioned in track-guide carriage (5), between the upper and lower chain of tracks (2), and is subject to the action of actuating means (22) which control its sliding movement to move it from said rest position to said operational position and vice versa.
- 3) Machine as claimed in claim 2, characterised in that said plate (19) is an iron plate moved by means of one or more hydraulic cylinders (22).
- 4) Pipe-laying machine as claimed in any of the preceding claims, characterised in that it includes an engine unit (3) and cab (4) located at each end of chassis (1), so as to leave a free space in the central area in which the crane driving devices (6, 7) are installed.
- 5) Perfected pipe-laying machine as claimed in any of the preceding claims, characterised in that all four wheels (23) on which the crawler tracks are mounted are drive wheels.
- 6) Pipe-laying machine as claimed in claim 5, characterised in that it includes track-tensioning devices consisting of rocker-arm elements (24) mounted on telescopic supports (26) and fitted with one or more rollers

(25) designed to engage the tracks.

7) Pipe-laying machine as claimed in any of the preceding claims, wherein crane boom (10) consists of tubular elements hinged, at the base, to the vehicle chassis and connected, at the top, to a cable (8) operated by a winch (6) to vary the inclination of said crane boom, said machine being characterised in that the connectors of said boom consist of a first plate (12) fixed to the structure of the machine and a second plate (14) to which pairs of projecting wings (11) are welded, the tubular elements that constitute the crane boom being hinged to said wings, and said second plate being removably coupled to said first plate.

8) Pipe-laying machine as claimed in claim 6, characterised in that the contact surfaces of said first and second plate (12, 14) have complementary shapes, to facilitate their exact mutual positioning.

9) Perfected pipe-laying machine as described and illustrated.

Fig. 1

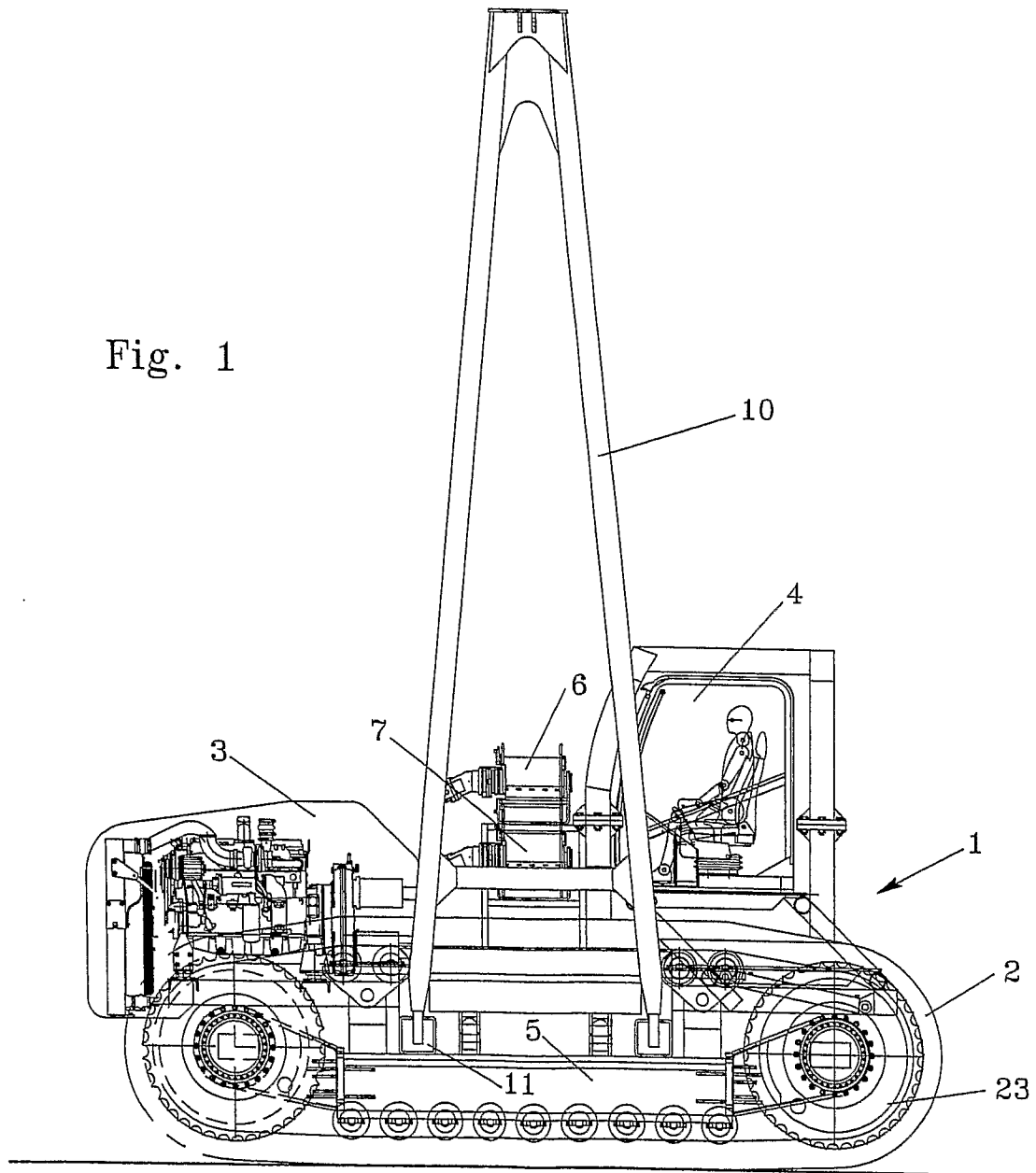
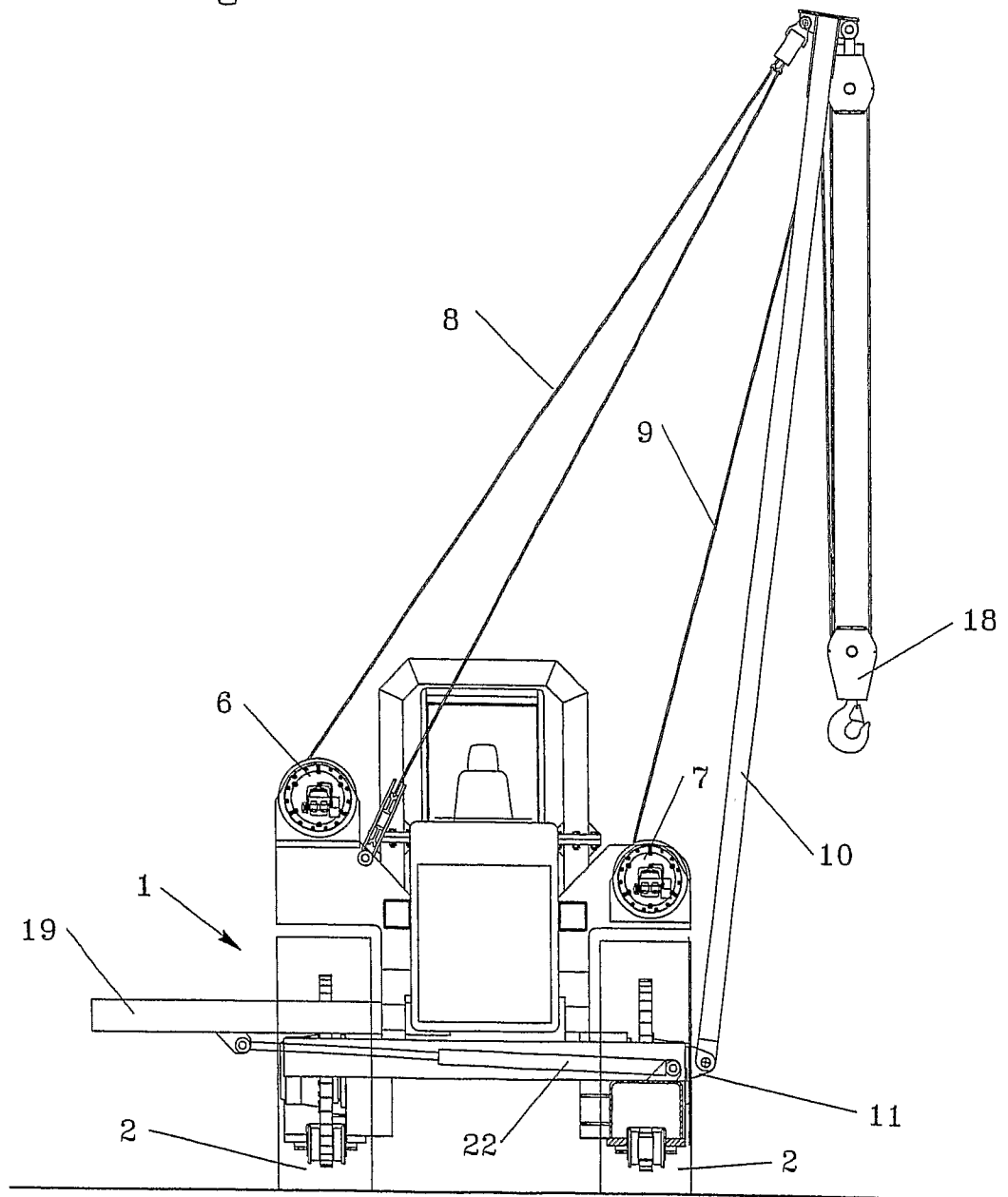


Fig. 2



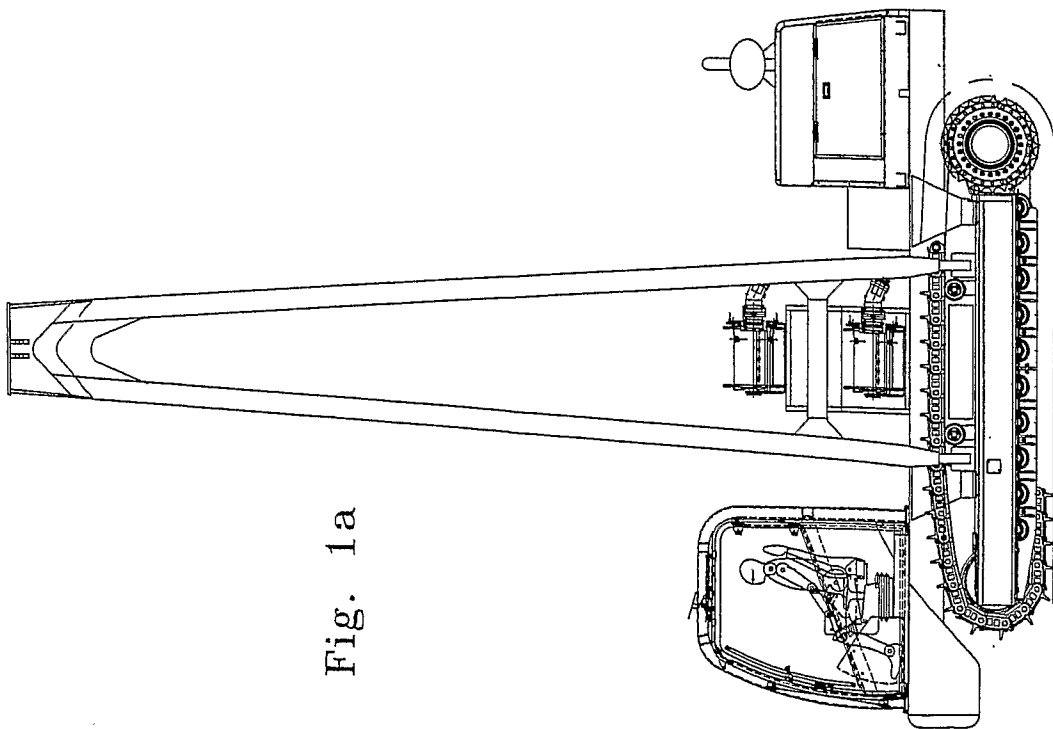
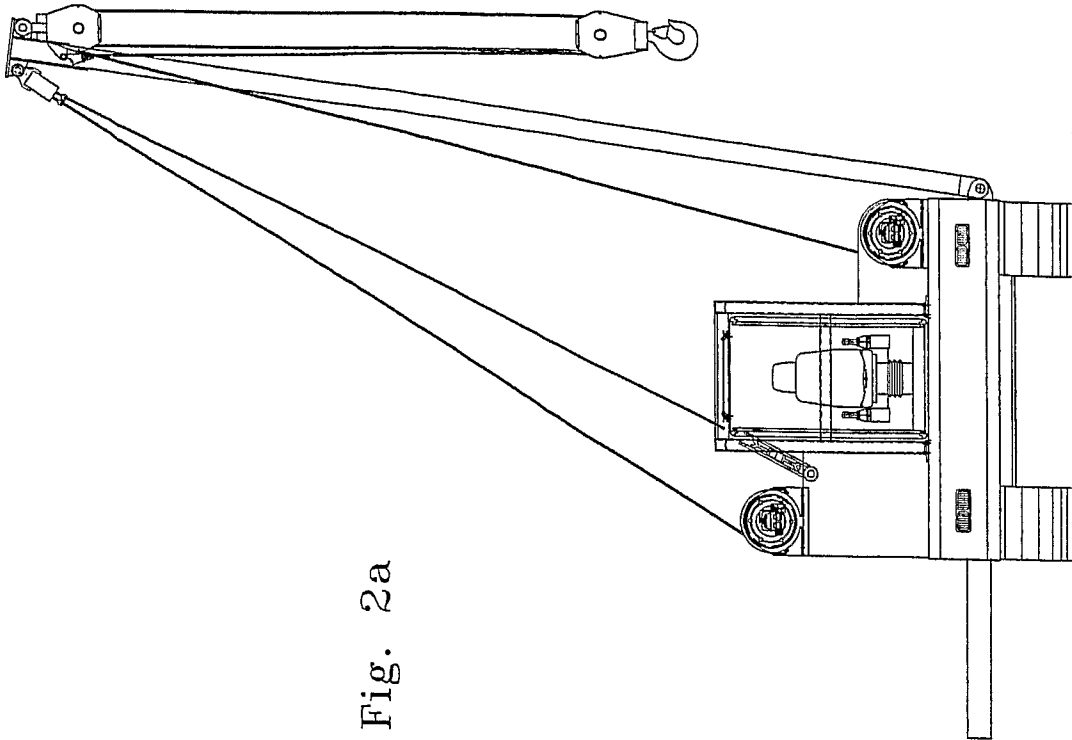


Fig. 4a

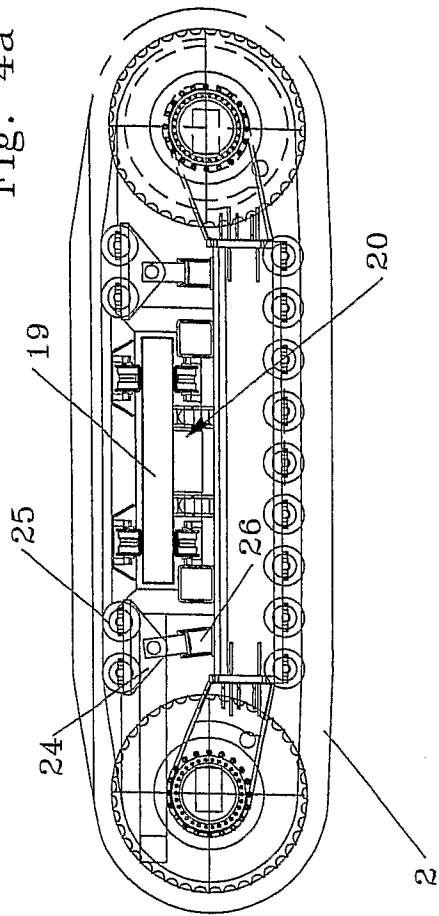


Fig. 3a

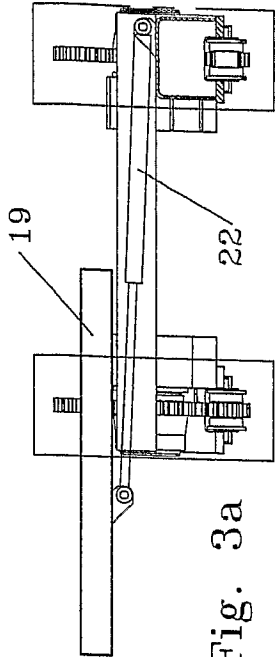


Fig. 3b

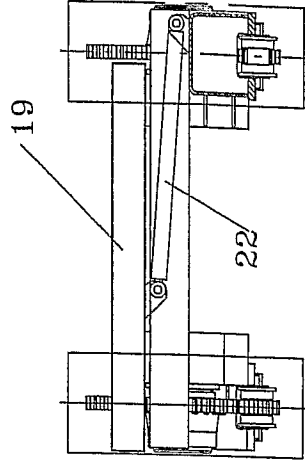
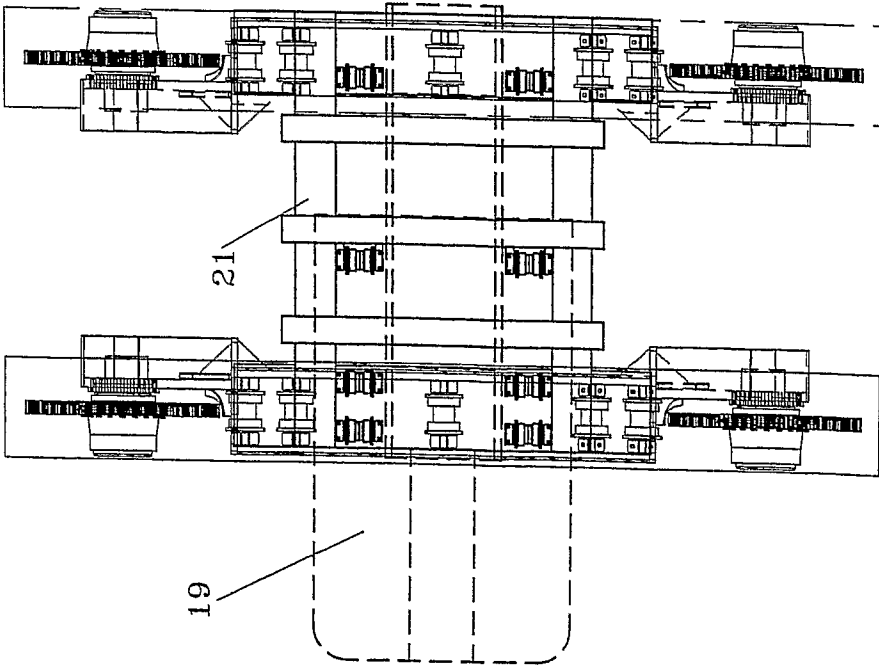
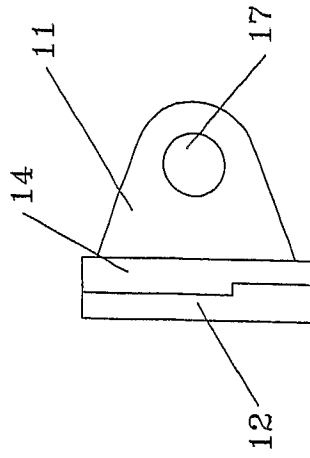
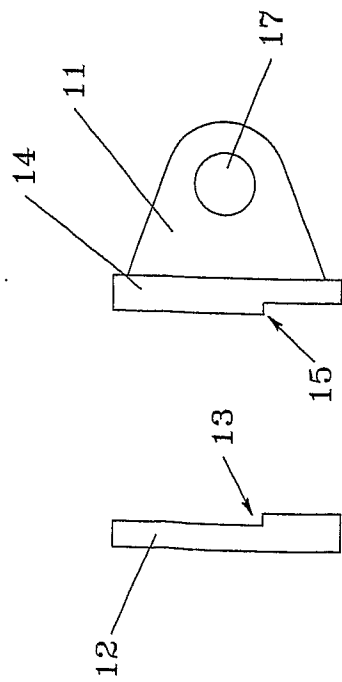
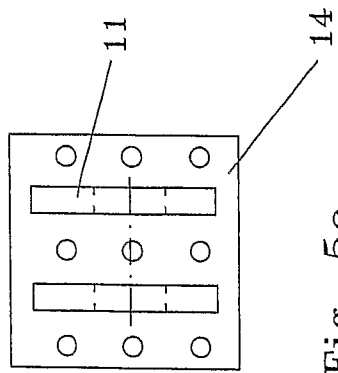
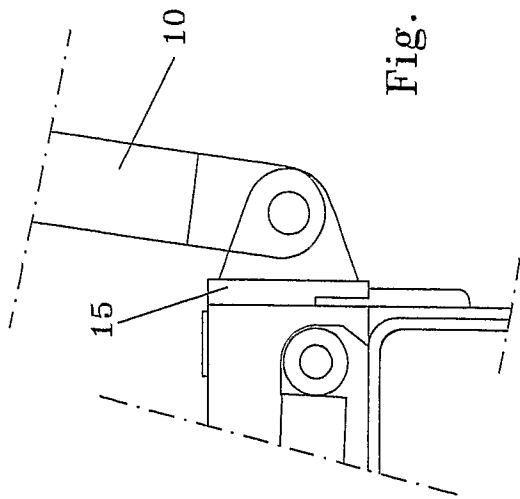


Fig. 4b





INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2007/001135

A. CLASSIFICATION OF SUBJECT MATTER
INV. B66C23/76 F16L1/028

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B66C E21B F16L B62D B66D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 083 459 A (ALLEN JAN K) 11 April 1978 (1978-04-11)	1
Y	the whole document	5,6
X	US 2001/009241 A1 (HARINGER ALOIS JOHANN [IT]) 26 July 2001 (2001-07-26)	1
A	the whole document	2
Y	EP 1 362 773 A (MACMOTER SPA [IT]) 19 November 2003 (2003-11-19) abstract; figure 1	5
Y	US 4 817 746 A (PURCELL ROBERT J [US] ET AL) 4 April 1989 (1989-04-04) the whole document	6
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

21 November 2007

Date of mailing of the international search report

30/11/2007

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2007/001135

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 332 110 A (FORSYTH RAYMOND [CA]) 26 July 1994 (1994-07-26) the whole document -----	1
A	US 4 132 317 A (ARENDT GEORGY A ET AL) 2 January 1979 (1979-01-02) the whole document -----	1
A	NL 8 102 087 A (MANITOWOC CO) 1 September 1981 (1981-09-01) figures 1,3 -----	5
A	EP 0 362 062 A (ARMEF [FR]) 4 April 1990 (1990-04-04) abstract; figure 1 -----	6

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.1

Claims Nos.: 9

Claim 9 is not defined in terms of technical features but only in terms of references to the description and the drawings. According to Rule 6.2(a) PCT, claims should not contain such references except where absolutely necessary, which is not the case here.

Continuation of Box II.2

Claims Nos.: 9

Claim 9 is not defined in terms of technical features but only in terms of references to the description and the drawings. According to Rule 6.2(a) PCT, claims should not contain such references except where absolutely necessary, which is not the case here.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2007/001135

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 9
because they relate to subject matter not required to be searched by this Authority, namely:
Claim 9 is not defined in terms of technical features but only in terms of references to the description and the drawings. According to Rule 6.2(a) PCT, claims should not contain such references except where absolutely necessary, which is not the case here.
2. ☒ Claims Nos.: 9
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☒ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
1-3, 5-6
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1,2-3

Dependent claims 2 and 3 in combination with claim 1: directed to a pipe-laying machine characterized by the following special technical feature: the position of the counterweight in a track-guide carriage between the upper and lower chain of tracks

2. claims: 1,4

Dependent claim 4 in combination with claim 1: directed to a pipe-laying machine characterized by the following special technical feature: the arrangement of the engine unit and of the cab on the chassis

3. claims: 1,5-6

Dependent claims 5 and 6 in combination with claim 1: directed to a pipe-laying machine characterized by the following special technical feature: the track drive with all four wheels being drive wheels

4. claims: 1,7-8

Dependent claims 7 and 8 in combination with claim 1: directed to a pipe-laying machine characterized by the following special technical feature: the connection of the articulated crane boom to the chassis

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2007/001135

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