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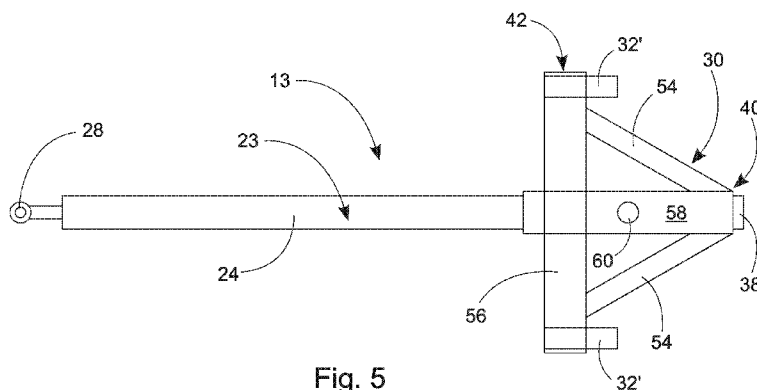


Fig. 5

(57) Abstract: The invention relates to an arrangement in connection with the trailer of a truck, in which the trailer (12) includes a chassis (18) and a drawbar (13) pivoted to the front bogie (44) of the chassis (18), which drawbar (13) includes an A-frame structure (30) pivoted to the front bogie (44), an arm (23) connected to the A-frame structure (30), and a coupling head (28) at its opposite end for coupling the drawbar (13) to the truck (14) towing the trailer (12). The A-frame structure (30) of the drawbar (13) narrows away from the said coupling head (28) and the said drawbar (13) is telescopic. The invention also relates to a corresponding drawbar (13) and a swap-body combination vehicle.

**ARRANGEMENT IN CONNECTION WITH THE DRAWBAR OF A TRAILER, A  
CORRESPONDING DRAWBAR, AND A SWAP-BODY COMBINATION VEHICLE**

The present invention relates to an arrangement in connection  
5 with the trailer of a truck, in which the trailer includes a  
chassis and a drawbar pivoted to the front bogie of the  
chassis, which drawbar includes an A-frame structure pivoted to  
the front bogie, an arm connected to the A-frame structure, and  
a coupling head at its opposite end for coupling the drawbar to  
10 the truck towing the trailer. The invention also relates to a  
corresponding drawbar and a swap-body combination vehicle.

Various types of drawbars between a truck and a trailer are  
known from the prior art. The drawbar is attached to the front  
15 bogie of the trailer, in front of the front-most axles of pair  
of wheels, with the aid of an A-frame structure belonging to  
the drawbar. There are both fixed and telescopic drawbars.  
Drawbars equipped with lifting and lowering gates are also  
known, in which the drawbar is lowered to the ground with the  
20 aid of a separate pivoted structure. Known solutions are  
manufactured, for example in Finland, by TMT.Malinen Oy, under  
the product name Trako. Other known solutions are represented  
by, for example, the drawbars imported by Oy ARNE STARA Ab.

25 A drawbar must meet the provisions of road traffic legislation  
in terms of the maximum and minimum distance between the truck  
and the trailer, when the target is a specific load.  
Conventional fixed drawbars are generally dropped onto the  
ground from the coupling-head end when the trailer is not  
30 coupled to a truck. In that case, when the truck is being  
reversed onto the trailer, the drawbar can damage the truck and  
vice versa. For its part, a lifting and lowering gate is  
intended to drop the drawbar over its entire length close to,  
or onto the ground, so that it cannot damage the truck when the  
35 truck is reversed to couple onto the trailer. However, lifting  
and lowering gates are complicated, heavy, and expensive

structures. In addition, when lowered onto the ground the drawbar becomes dirty.

The drawbar is attached very low on the front bogie, so that  
5 the truck can be reversed against the trailer when swapping bodies, or close when using a hook device, when the drawbar is dropped to the ground at one end.

When transporting a truck-and-trailer combination by ship, it  
10 is important to minimize their overall length for the duration of the voyage. Overall length can be reduced slightly by using a telescopic drawbar, but even with it the tolerance of adjustment is quite small. A particular problem is trailers, in which there is a short front overhang, in which case the A-  
15 frame structure of the drawbar must be installed in front of the chassis of the trailer.

The present invention is intended to create a more versatile and cheaper arrangement in connection with the drawbar of a  
20 trailer than the arrangements of the prior art, which will permit a truck to be reversed to couple a trailer. The characteristic features of the arrangement according to the present invention are stated in the accompanying Claim 1. The invention is also intended to create a more versatile drawbar  
25 for trailers than the drawbars according to the prior art, which will permit a truck to be reversed to couple a trailer. The characteristic features of the drawbar according to the present invention are stated in the accompanying Claim 8. Further, the invention is intended to create a more versatile  
30 swap-body combination vehicle than the swap-body vehicle combinations of the prior art, in which it is possible to reverse the truck to couple the trailer. The characteristic features of the swap-body combination vehicle according to the present invention are stated in the accompanying Claim 9.

The intention of the arrangement according to the present invention can be achieved by means of an arrangement in connection with a truck trailer, in which the trailer includes a chassis and a drawbar pivoted to the front bogie of the 5 chassis. The drawbar includes an A-frame structure pivoted to the front bogie, an arm connected to the A-frame structure, and a coupling head connected to its opposite end for coupling the drawbar to the truck towing the trailer. The A-frame structure of the drawbar narrows away from the coupling head. Thus, the 10 structure of the drawbar is shortened and thus the length of the entire combination of the truck and trailer shortens. The short structure of the drawbar enables the truck to be reversed to the chassis of the trailer, or close to the chassis of the trailer.

15

The drawbar is preferably telescopic. A telescopic drawbar will permit a truck to reverse onto a trailer chassis, or close to it, when the drawbar is in the drawbar coupling of the truck.

20 According to one embodiment, the A-frame structure includes angled supports at an angle to the arm, and a transverse support, in which the intersection of the angled supports and the arm is the narrow end of the A-frame structure, and the A-frame structure further includes second angled supports, which 25 are at an angle to the arm and on the opposite side of the transverse support relative to the angled supports. Thus, the A-frame structure can be shortened while the second angled supports stiffen the structure.

30 The truck preferably includes an automatic drawbar coupling for locking the drawbar automatically to the truck. Mechanical transmission means between the truck and the trailer can be replaced with the aid of the automatic drawbar coupling, so that the total weight of the combination will be reduced. 35 Energy can be transferred from the truck to the trailer through

the automatic drawbar coupling. In addition, the automatic drawbar coupling will make the arrangement easier to operate.

The arrangement can include attachment lugs, with the aid of  
5 which the drawbar is attached to the trailer under the front bogie.

The trailer preferably includes means for keeping the coupling head off the ground. Thus, the drawbar and its coupling head  
10 will remain clean, even when the trailer is uncoupled from the truck.

The drawbar is preferably arranged in such a way that, at its shortest, it will fit between the truck and the trailer, when  
15 the drawbar is in the drawbar coupling. Thus, the total length of the truck and trailer is made short.

According to one embodiment, the trailer can have a front overhang that is at most 1.4 m, preferably 0.4 - 1.0 m. The  
20 invention is particularly suitable for use in trailers with a short front overhang.

The drawbar can be pivoted to the front bogie of the trailer, above the front axle belonging to the trailer. In that case,  
25 the truck's drawbar coupling too can be placed in a high location to protect from dirtying.

According to one embodiment, the A-frame structure is fitted essentially entirely under the chassis of the trailer. Thus,  
30 with the aid of already existing drawbar structures, it is possible to shorten the distance between a truck and a trailer, while nevertheless meeting the laws and regulations applying to the sector.

35 The intention of the drawbar according to the present invention can be achieved by means of a drawbar, which includes an A-

frame structure pivoted to the front bogie of the trailer, an arm connected to the A-frame structure, and a coupling head connected to its opposite end for coupling the drawbar to the truck towing the trailer. The A-frame structure of the drawbar  
5 narrows away from the coupling head. Thus, the A-frame structure of the drawbar can be located entirely, or at least substantially under the chassis of the trailer.

The drawbar is preferably telescopic. A telescopic drawbar  
10 permits the truck to be reversed onto, or close to the trailer, even with trailers with a short front overhang, without having to lower the drawbar to the ground.

By means of the solution according to the invention, the  
15 advantage is achieved that a truck can always be reversed close to, or onto a trailer.

In the following, the invention is described in greater detail with reference to the accompanying figures depicting some  
20 embodiments of the invention, in which

Figures 1a - 1b show one embodiment of the arrangement and swap-body combination vehicle according to the invention, in connection with a cassette trailer, when the arm of the drawbar is  
25 telescopic,

Figure 2 shows a first embodiment of the arrangement according to the invention, seen from the side of a cassette trailer, without the load space, the telescopic arm being in the  
30 extracted position,

Figure 3 shows a side view of an enlargement of the drawbar of Figure 2, the telescopic arm being in the extracted position,

Figure 4 shows a top view of one embodiment of the drawbar of the arrangement according to the invention, depicted separately,

Figure 5 shows a top view of a second embodiment of the drawbar of the arrangement according to the invention, depicted separately,

Figure 6 shows a second embodiment of the arrangement according to the invention in connection with a swap-body trailer, the arm of the drawbar being telescopic,

Figures 7a - 7b show the second embodiment of the arrangement according to the invention, seen from underneath the swap-body trailer, without the load space and the telescopic arm in different positions,

Figure 8a shows a top view of the enlargement of the drawbar of Figure 7a, the telescopic arm being in the retracted position,

Figure 8b shows a top view of the enlargement of the drawbar of Figure 7b, the telescopic arm being in the extracted position.

In Figures 1a - 8b unified reference numbering relating to the various components is used. The reference numbers are

10	arrangement	24	drawbar's telescopic arm
12	trailer	26	guide pin
13	drawbar	28	drawbar coupling head
14	truck	30	A-frame structure
16	load space	32	attachment lug
18	trailer chassis	32'	attachment lug
20	trailer wheels	34	front axle
22	trailer front wheels	35	front-most axle
22'	bogie wheels	36	air spring
23	drawbar arm	40	narrow end of A-frame structure

42	wide end of A-frame structure	64	hydraulic hoses and electrical leads
44	front bogie	66	attachment
46	pivot	68	trailer rear wheels
5 48	lug	69	hook device
50	turntable	70	truck's rear axle
52	brakes	72	edge of truck's chassis
54	angled supports	74	pivot pin of front spring
54'	second angled supports		
10 56	transverse support	76	automatic drawbar coupling
58	telescopic drawbar outer part	80	front end of trailer chassis
60	hole		
62	truck's drawbar coupling		

15 According to Figure 1, the invention relates to an arrangement 10 in a trailer 12, which is towed by a freight vehicle 14. Figure 1 shows an embodiment, in which the freight vehicle 14 is a truck and the trailer 12 is a short cassette trailer 12, in which there is a load space 16, i.e. a cassette skip. Figure 20 1a shows the cassetting stage, in which the truck 14 has been reversed onto the trailer 12. In the arrangement 10 according to the invention, the drawbar 13 is located in such a way that it permits the truck 14 to always be reversed onto the trailer 12 up to the edge 72 of the chassis of the truck 14, shown in 25 Figure 1b, onto the guide pins 26 attached to the end of the chassis 18 of the trailer 12. In the loading situation, the arrangement can include locking means for locking the truck.

Figures 2 and 3 show a first embodiment of the arrangement 30 according to the invention, in which the trailer 12 has a long front overhang. The term front overhang refers to the distance between the chassis 18 and the front axle 34 of the trailer 12. Figures 5 - 8b, for their part, show a second embodiment of the arrangement according to the invention, in which there is a 35 short front overhang in the trailer.

In the embodiments shown in Figures 1a - 8b, the drawbar 13 is telescopic. When using a telescopic drawbar 13, the arm 23 of the drawbar, i.e. in this case the telescopic arm 24, pushes inside under the trailer 12. When towing the trailer 12 on a road, the drawbar 13 can be extended to its maximum length, which is shown in Figure 1b. The use of a telescopic arm in the drawbar permits the load space to be transferred from the trailer to the truck, without uncoupling the drawbar from the truck's drawbar coupling.

10

In Figure 1a, the telescopic arm 24 of the drawbar 13 of the arrangement 10 is in the retracted position, so that only the end of the telescopic arm 24 and the coupling head 28 attached to the end (shown in Figures 4 and 5) remain outside the chassis 18 of the trailer 12. The coupling head 28 is preferably a towing eye 28 or similar. According to the figure, the hydraulics and electricity required by the trailer 12 can be supplied to it with the aid of hydraulic hoses and electric leads 64, which can be attached to the undersurface of the arm 23. Thus, when using the telescopic arm, they will be off the ground in all the situations, where they are protected from dirtying and damage.

Figure 2 shows a side view of the arrangement according to a first embodiment of the invention. In this embodiment, the front overhang of the trailer 12 is long, so that the drawbar 13 can be attached farther back on the front bogie 44 of the turntable 50 of the trailer 12 (shown in Figure 3). The drawbar 13 includes an arm 23, a coupling head 28, and an A-frame structure 30. The A-frame structure 30 is intended to distribute the lateral forces of the telescopic arm 24 evenly over the attachment of the drawbar 13. The A-frame structure 30 is attached at its wider end to the attachment lugs 32.

In solutions according to the prior art, the attachment lugs are generally located close of the truck-side end of the frame

of the front bogie, at the front end of front bogie 44, as shown in Figure 3. Thus, in arrangements according to the prior art, most of the A-frame structure narrowing towards the truck, is in front of the front bogie of the trailer, between the truck and the trailer, preventing the truck from reversing onto the trailer. In the first embodiment of the arrangement according to the invention of Figures 2 and 3, the attachment point of the A-frame structure 30 has been moved backwards, which permits the coupling head 28 of the drawbar 13 to come closer to the chassis 18 of the trailer 12. The A-frame structure 30 can be entirely concealed under the chassis 18, even under the front bogie.

Figure 3 shows an enlargement of the embodiment of Figure 2. It can be seen from the figure how the attachment lug 32 can be attached to the undersurface of the front bogie 44. The front bogie 44 is a support structure, with the aid of which the front wheels 22 are connected to the turntable 50 and through it to the chassis 18. The A-frame structure 30 is preferably pivoted to the attachment lug 32 with the aid of a horizontal pivot 46, which permits the vertical movement of the drawbar 13. The arrangement preferably also includes means, which prevent the drawbar from falling to the ground, when the drawbar is uncoupled from the truck.

25

Figures 4 and 5 show top views of detached drawbars according to two possible embodiments of the arrangement according to the invention. The drawbar 13 consists of an arm 23, a coupling head 28 attached to the end of the arm 23, and an A-frame structure 30. In the case of Figures 4 and 5, the arm 23 is a telescopic arm 24. For its part, the A-frame structure 30 includes a hollow outer part 58 of the telescopic drawbar, attached around the telescopic drawbar 24, a transverse support 56 at right-angles to the telescopic drawbar 24, and angled supports 54 between the transverse support 56 and the outer part 58 of the telescopic drawbar. In the embodiment of Figures

2 and 3, the A-frame structure used can be according to Figure 4, i.e. the A-frame structure 30 includes angled supports 54, as well as second angled supports 54', the attachment point of which second angled supports 54' to the arm 23 is closer to the truck than the transverse support 56 of the A-frame structure. In other words, the second angled supports 54' narrow towards the truck and are located on the opposite side of the transverse support 56 relative to the angled supports 54. Thus, the angled supports 54 and the second angled supports 54' form a structure with a lozenge shape, which can be symmetrical or asymmetrical. With the aid of the second angled supports 54' the length of the angled supports 54 can be shortened, in which case the total length of the entire A-frame structure 30 will shorten.

15

In the embodiment of Figure 5, the A-frame structure is implemented without second angled supports, in which case the intersection of the outer part 58 and the angled supports 54 form the narrow end 40 of the A-frame structure 30 and the intersection of the transverse support 56 and the angled supports 54, for its part forms the wide end 42. The narrow end 40 of the A-frame structure 30 includes a feed-through 38, through which the telescopic arm 24 runs to the hollow outer part 58. In the outer part 58, there are also locking means 60, through which the telescopic arm 24 can be locked in place. The figure also shows the attachment lugs 32' attached to the transverse support 56 of the A-frame structure 30, with the aid of which the drawbar 13 is attached, in the embodiment of the arrangement according to Figures 6 - 8b. The drawbar 13 is preferably pivoted to the attachment lugs 32'.

All the embodiments of the invention have in common the narrowing of the A-frame structure of the drawbar when proceeding away from the coupling head of the drawbar, i.e. towards the rear of the trailer. In other words, the narrow end of one A-frame structure points backwards.

Figures 6 - 8b show a second embodiment of the arrangement according to the invention, in which the front overhang of the trailer is short, at most 1.4 m, preferably 0.4 - 1.0 m. Figure 6 shows an embodiment of the second arrangement 10, in which the trailer 12 is a long swap-body trailer, in which two load spaces 16, i.e. skips, are transported. In this embodiment, the truck 14 includes a hood device 69, with the aid of which the load space 16 can be pulled on and off the truck 14. In this embodiment too, it is important that the truck 14 can be reversed entirely or nearly onto the trailer 12, so that the hook device 69 will reach to engage on the counterpart of the load space 16. When using a long swap-body trailer, the trailer 12 generally includes bogie front wheels 22', which are attached to the turntable of the chassis 18 of the trailer 12 with the aid of a front bogie 44. In such a trailer, there is a considerably short front overhang, so that the space for attaching the A-frame structure will also remain small.

Figures 7a and 7b show a view from underneath of a long trailer 12. When the distance between the front end 80 of the chassis 18 of the trailer 12, i.e. the front overhang, is small, the embodiment of the drawbar according to Figure 5 is used. The A-frame structure is attached to the front end of the front bogie 44 of the trailer 12 at its wide end 42. The narrow end 40 of the A-frame structure 30 is farther from the truck than the wide end 42. Thus, the A-frame structure 30 does not take up space between the truck and the trailer. Such an embodiment requires the use of a telescopic arm 24 in the drawbar 13, as the telescopic arm 24 can be pushed inside until the coupling head 28 is nearly or entirely at the front end of the trailer 12, thus permitting the transfer of a skip.

Figure 8a shows an enlargement of the situation in Figure 7a. It will be seen from the figure how the A-frame structure 30 is attached, with the aid of the transverse support 56, to the attachment lugs 32', which are, in turn, attached in front of

the front bogie 44. Unlike in the prior art, the A-frame structure is, however, set in such a way that it is essential entirely under the trailer 12. In other words, the A-frame structure is preferably arranged at its shortest to fit between 5 the truck and the trailer, when the drawbar is in the towing throat in the skip transferring situation. The telescopic arm 24, which has been pushed in, has space under the front bogie 44, between the air springs 36. The arrangement can include a spring element, for example a rubber cushion, which is under 10 the trailer, and which pushes the telescopic drawbar slightly outwards from the retracted position. Thus the telescopic drawbar can be brought again back to the drawbar coupling. According to Figure 8b, by means of the extracted telescopic arm 24, sufficient length of the drawbar 13 will be obtained 15 for driving. In the arrangement according to the invention, the angle of the drawbar relative to the horizontal never exceeds 5°, when the drawbar is attached to the drawbar coupling of the truck.

20 In the retracted position, the telescopic arm 24 of the drawbar 13 runs through the A-frame structure 30 and extends at least to the rear side of the front wheels 22 of the trailer 12. Because the air springs 36 (like leaf springs) are generally at the sides of the chassis 18, they are not an obstacle to the 25 telescopic arm 24 running under the chassis 18. For the same reason, disc brakes, which leave the central space free, are used. The construction of the telescopic arm can be according to Figure 5. The drawbar will then not be required to pivot downwards, nor need it ever be dropped onto the ground, when 30 the coupling head and the drawbar would be dirtied and would be liable to being damaged when the truck reverses.

The arrangement according to the invention is suitable for use in connection with different types of trailer, especially with 35 swap-body trailers. The arrangement according to the invention permits drawbars used in trailers equipped with single-axle

front wheels to also be used in trailers equipped with double-axle front wheels, and vice versa. In the arrangement according to the invention, when a telescopic arm is used, the drawbar is always off the ground in every situation. The electrical  
5 sockets and connectors also always remain off the ground.

According to one embodiment, in the truck there is a combination of the following type of an automatic drawbar coupling and a telescopic drawbar, which can also be used in an  
10 swap-body assembly whatever, irrespective of the swap-body transfer mechanism. In this solution, the trailer includes a telescopic drawbar and the drawbar coupling used in the truck is an automatic drawbar coupling. One such automatic drawbar coupling is the automatic drawbar coupling known by the product  
15 name MFC (Multi-Function Coupling) made by the Swedish manufacturer VBG GROUP Ab, in which the attachment of the drawbar and the hydraulic, pneumatic, and electrical connections are made automatically through the drawbar coupling. Thus, for example the hydraulic power required for  
20 transferring a cassette skip can be transmitted from the truck to the trailer through the automatic drawbar coupling, in which case mechanical power-transmission means between the truck and the trailer will become unnecessary. Such mechanical transmission means are disclosed, for example, in publication  
25 FI 88008 B, which transfer devices operated by hydraulic cylinders can, in this solution, be applied more simply, by exploiting the energy transmitted through the automatic drawbar coupling. Preferred transfer devices are disclosed in publications FI 88008 B, and EP 1487666 B1.

30

An automatic drawbar coupling is particularly advantageous when used with a telescopic drawbar, as the automatic drawbar coupling can then be located high between the truck's chassis beams, where the drawbar will fit in the skip transfer  
35 situation, between the truck and the trailer. This is especially important when using an automatic drawbar coupling,

because they are poorly resistant to dirt. For this reason, the automatic drawbar coupling cannot be located close to the ground, and a conventional drawbar that is lowered onto the ground would easily dirty both the drawbar coupling and the connection components of the drawbar. The construction of the automatic drawbar coupling can be similar to what is presented above and in publications EP 1710145, SE 1777084, and SE 1914094.

10 The telescopic drawbar can include an operating device for retracting it and control means controlling the operating device. Further, the telescopic drawbar preferably includes a self-power system, the power of which being used by the operating device. The system can be, for example, an electrical or pressure accumulator, or similar. The control means can be remotely operated from the truck. The operating device can be, for example, a hydraulic or pneumatic cylinder. With the aid of the operating device, the trailer's telescopic drawbar can be shortened without the truck. Thus, the reversing of the truck, in such a way that the truck's drawbar coupling meets the telescopic drawbar of the trailer, will be considerably easier when the telescopic drawbar is short.

**CLAIMS**

1. Arrangement in connection with the trailer of a truck, in which the trailer (12) includes a chassis (18) and a drawbar (13) pivoted to the front bogie (44) of the chassis (18), which drawbar (13) includes an A-frame structure (30) pivoted to the front bogie (44), an arm (23) connected to the A-frame structure (30), and a coupling head (28) at its opposite end for coupling the drawbar (13) to the truck (14) towing the trailer (12), characterized in that the A-frame structure (30) of the drawbar (13) narrows away from the said coupling head (28) and the said drawbar (13) is telescopic.

2. Arrangement according to Claim 1, characterized in that the A-frame structure (30) includes angled supports (54) at a slanting angle relative to the arm (23) and a transverse support (56), in which the intersection of the angled supports (54) and the arm (23) is the narrow end (40) of the A-frame structure (30), and the said A-frame structure (30) further includes second angled supports (54'), which are at a slanting angle relative to the arm (23) and at the other side of the transverse support (56) relative to the angled supports (54).

3. Arrangement according to Claim 1 or 2, characterized in that the said truck (14) includes an automatic drawbar coupling (76) for locking the said drawbar (13) automatically to the truck (14).

4. Arrangement according to Claims 1 - 3, characterized in that the trailer (12) includes means for keeping the coupling head (28) of the drawbar (13) off the ground.

5. Arrangement according to any of Claims 1 - 4, characterized in that the said A-frame structure (30) is arranged to be essentially entirely under the chassis (18) of the trailer (14).

6. Arrangement according to any of Claims 1 - 5, characterized in that in the said trailer (12) there is a front overhang, which is at most 1.4 m, preferably 0.4 - 1.0 m.
- 5 7. Arrangement according to any of Claims 1 - 6, characterized in that the said drawbar (13) is pivoted to the front bogie (44) of the trailer (12), above the front axle (34) belonging to the trailer.
- 10 8. Drawbar for a trailer, which drawbar (13) includes an A-frame structure (30) pivoted to the front bogie (44) of the chassis (18) of the trailer (12), an arm (23) connected to the A-frame structure (30), and a coupling head (28) at its opposite end for coupling the drawbar (13) to the truck (14) towing the trailer (12), characterized in that A-frame structure (30) of the drawbar (13) narrows away from the said coupling head (28) and the said drawbar (13) is telescopic.
- 15 9. Swap-body combination vehicle, characterized in that, in  
20 the swap-body vehicle combination, there is an arrangement according to any of Claims 1 - 7.

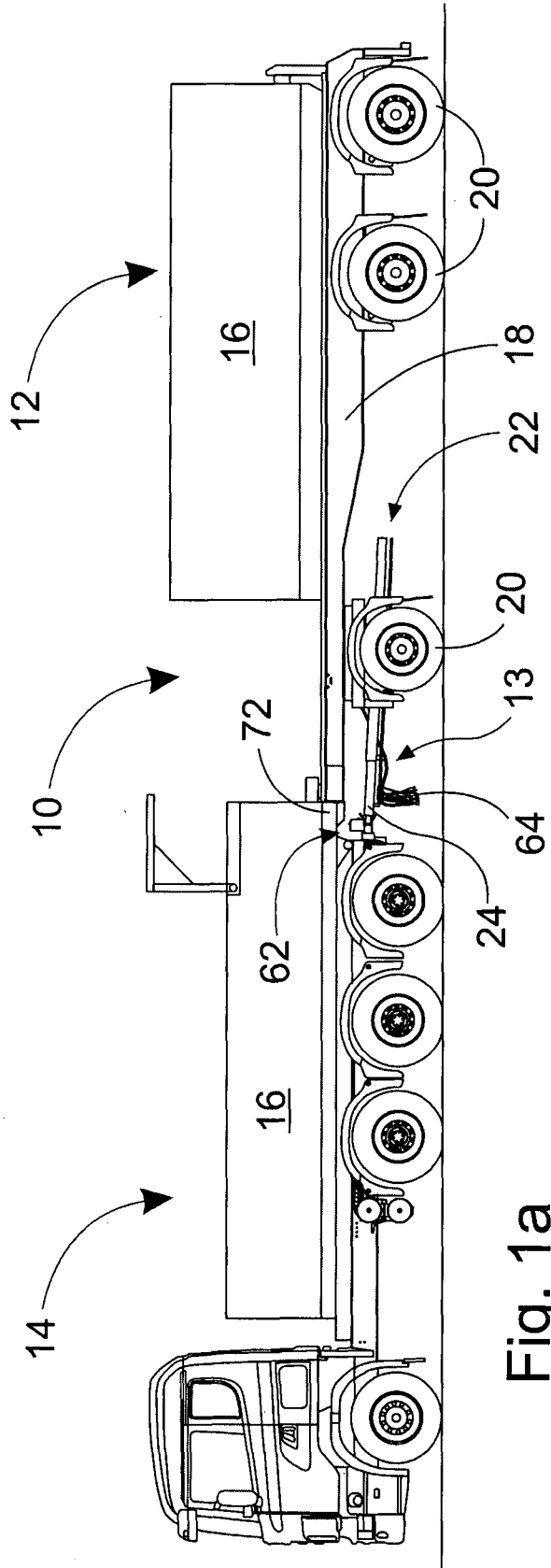


Fig. 1a

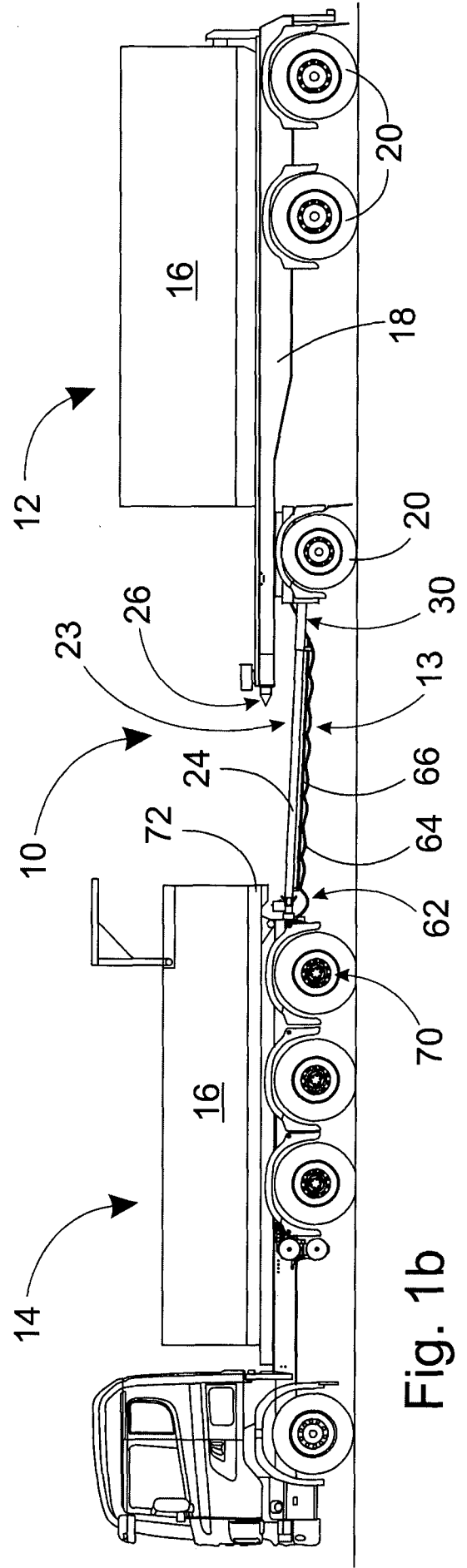


Fig. 1b

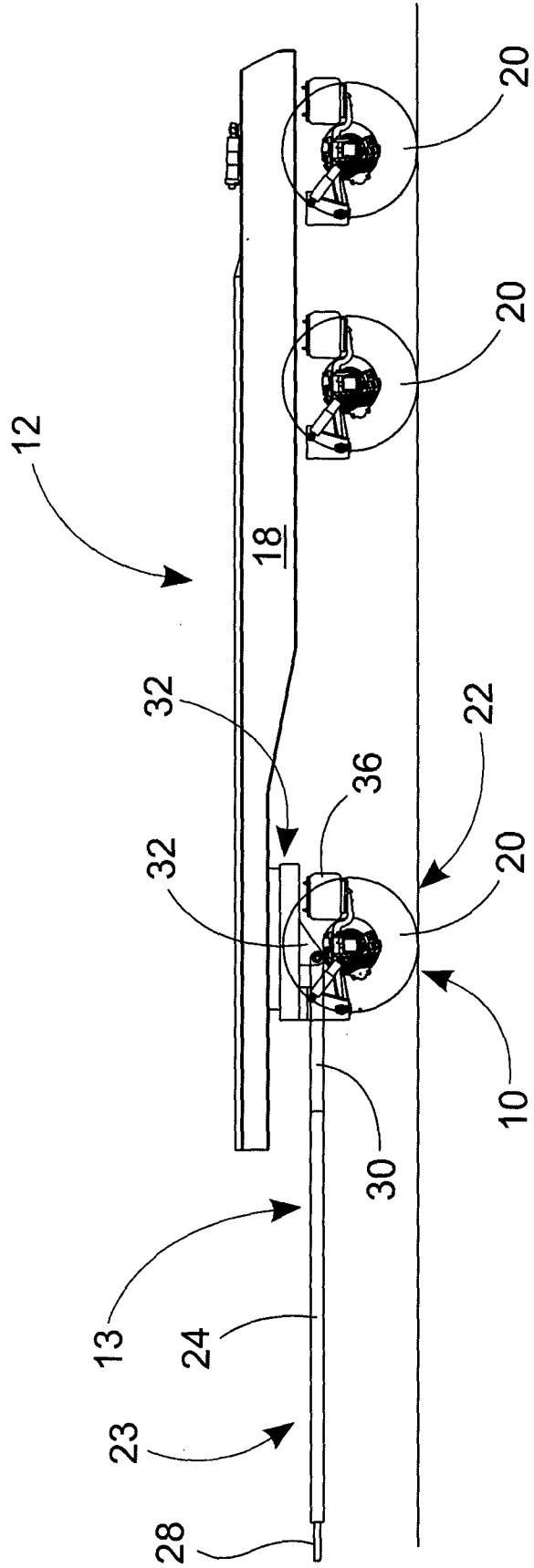


Fig. 2

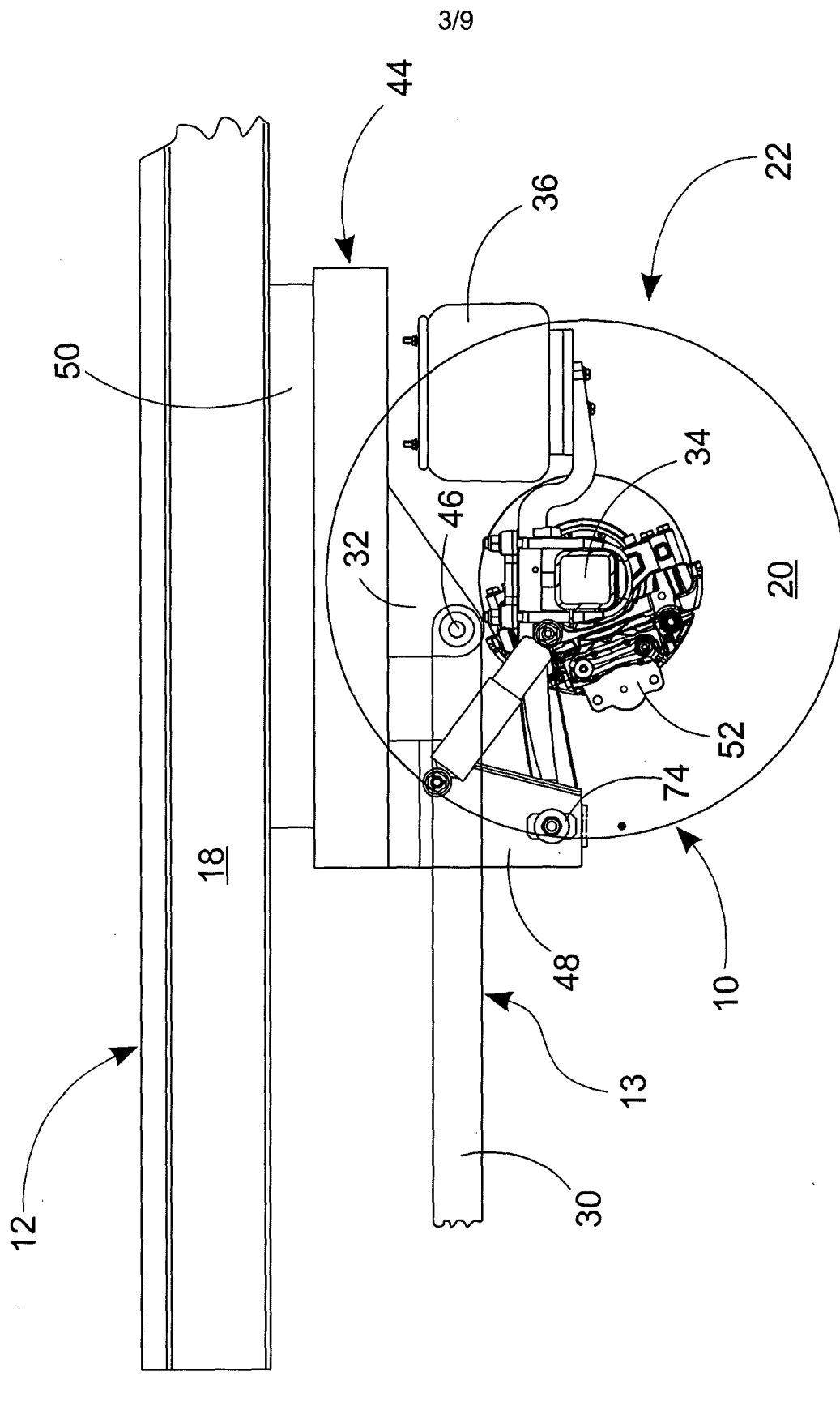


Fig. 3

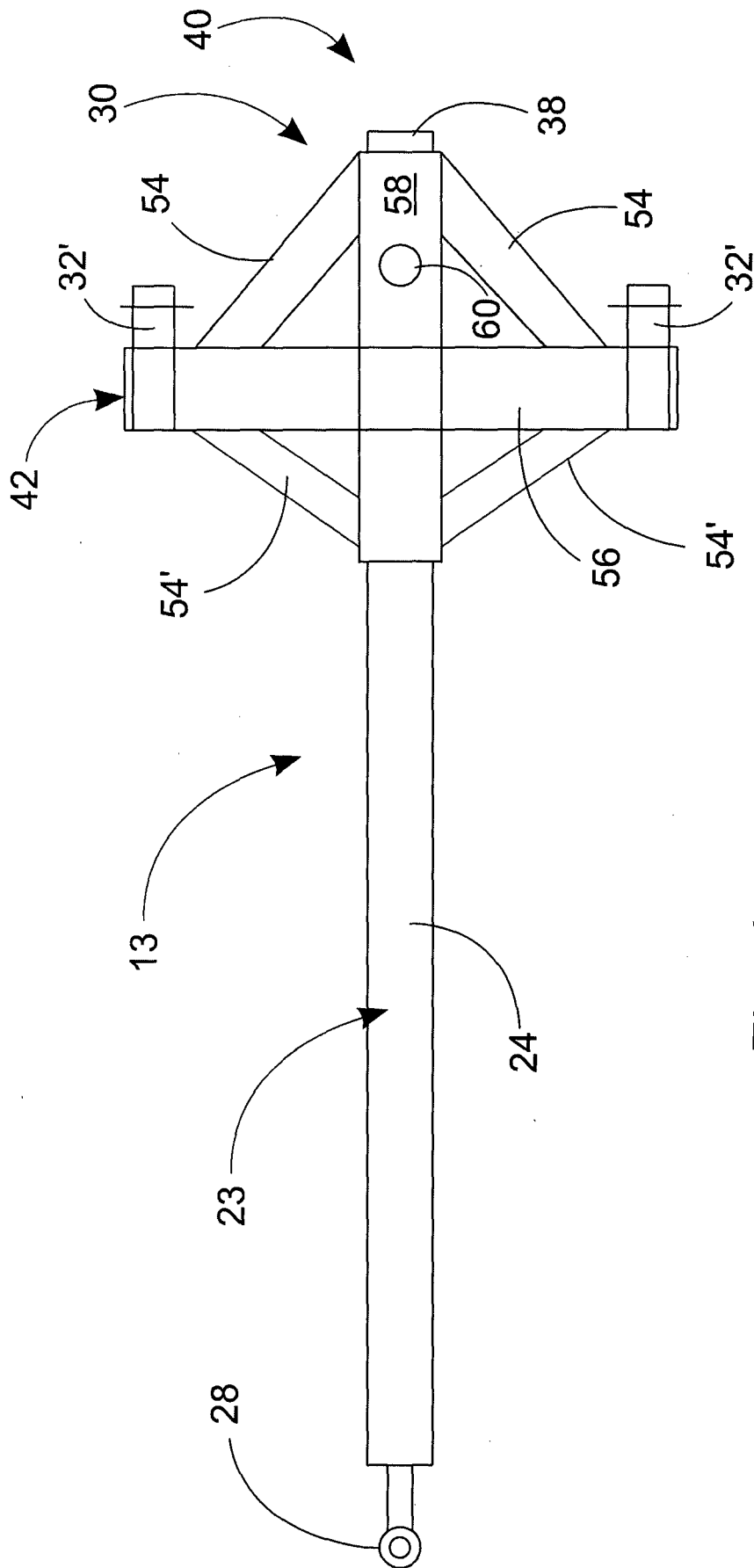


Fig. 4

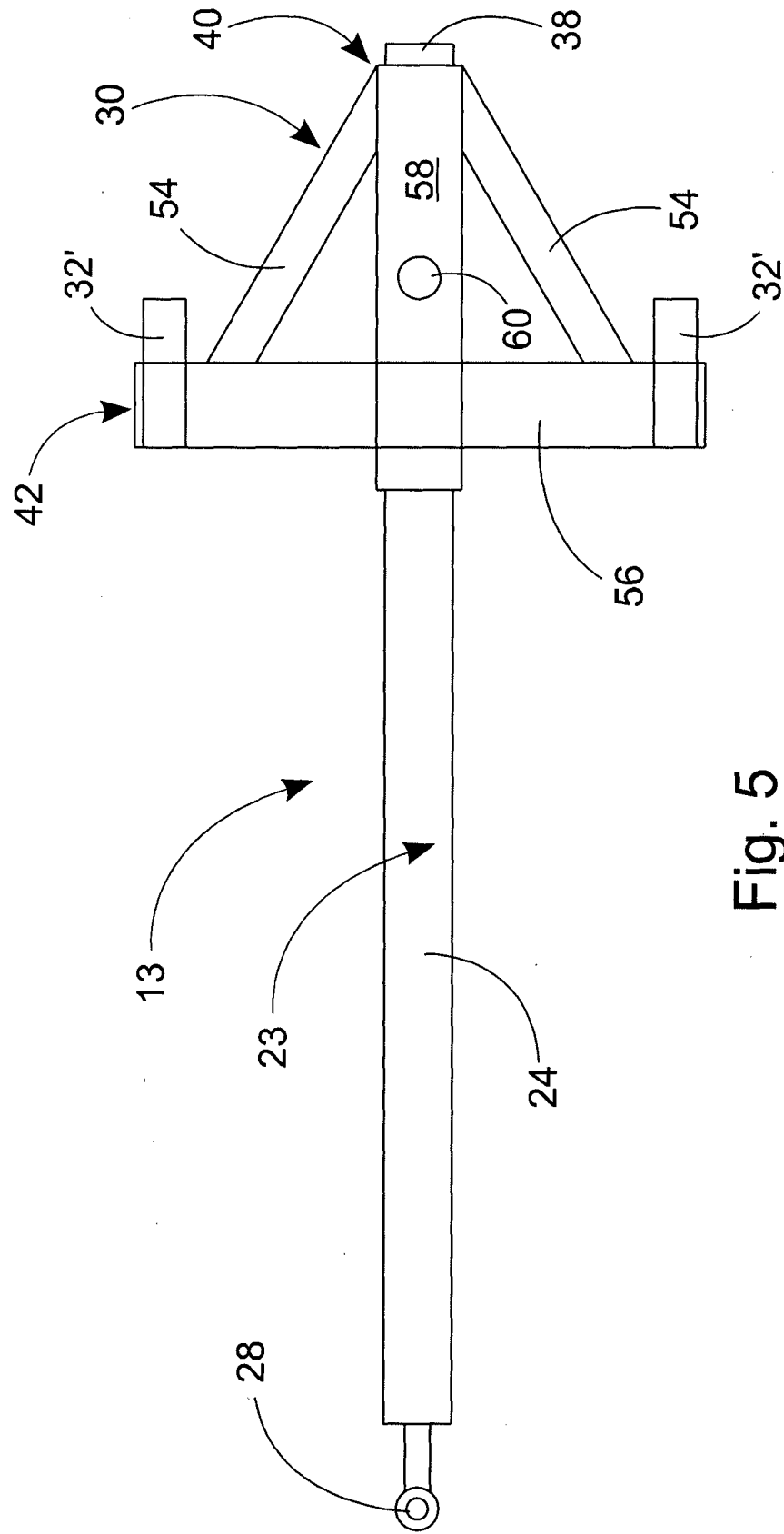


Fig. 5

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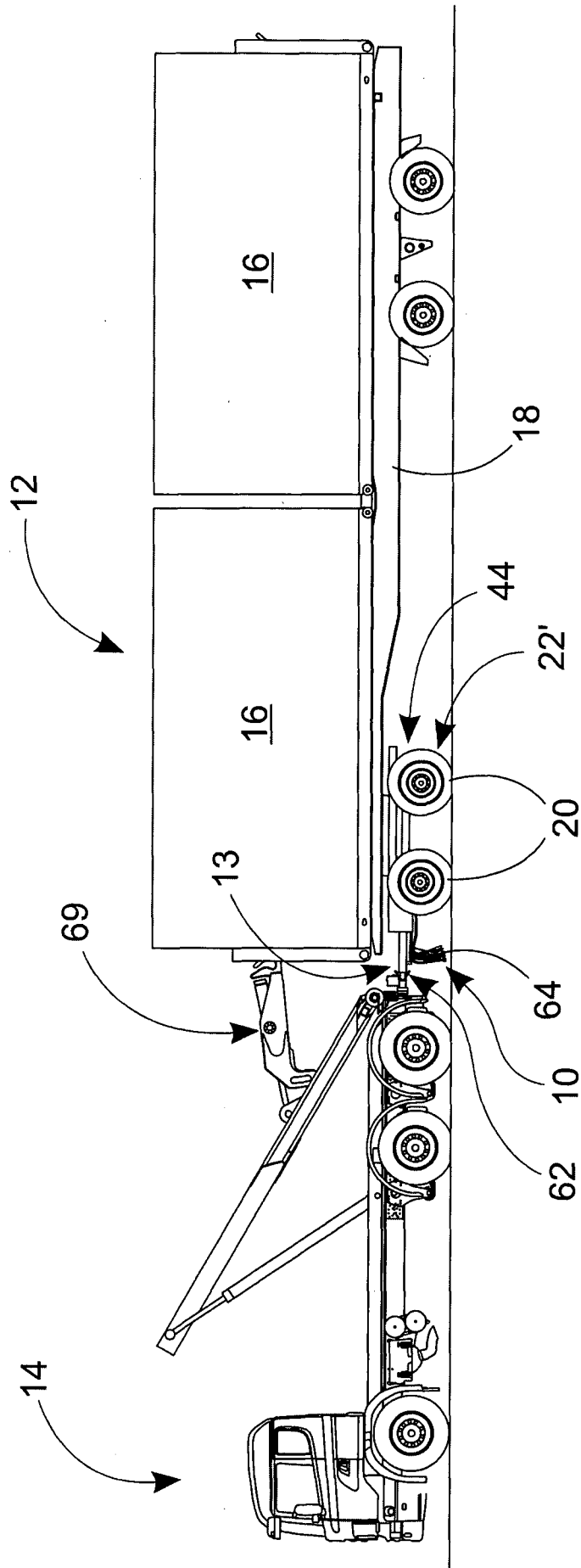


Fig. 6

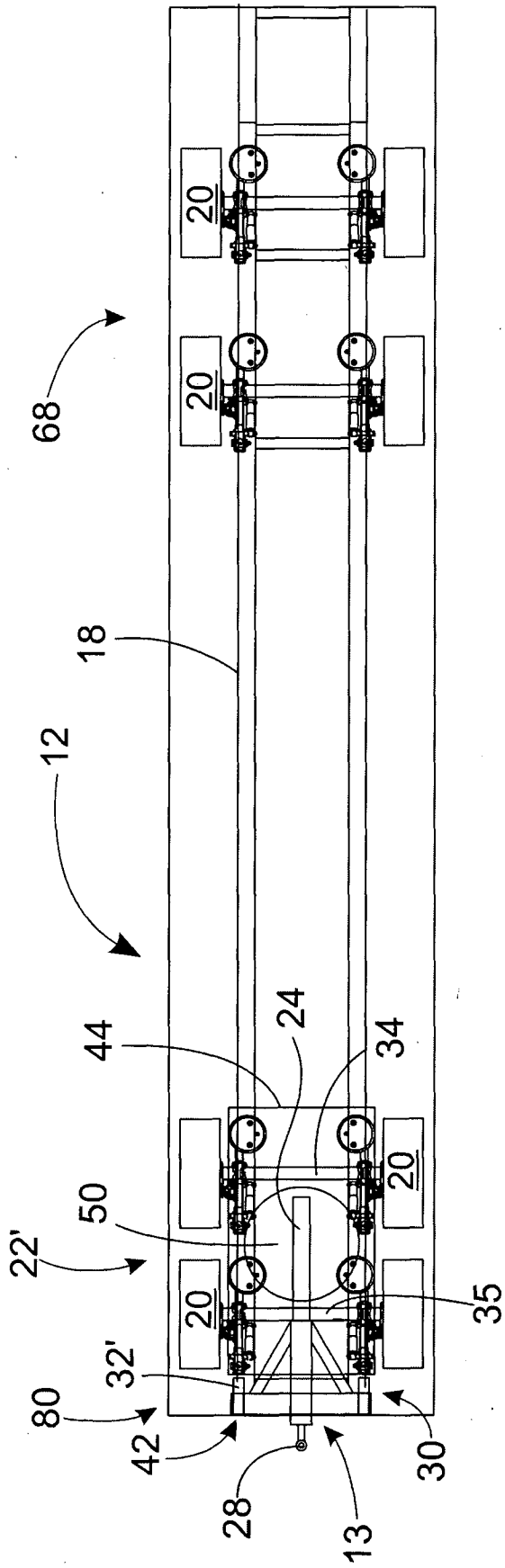


Fig. 7a

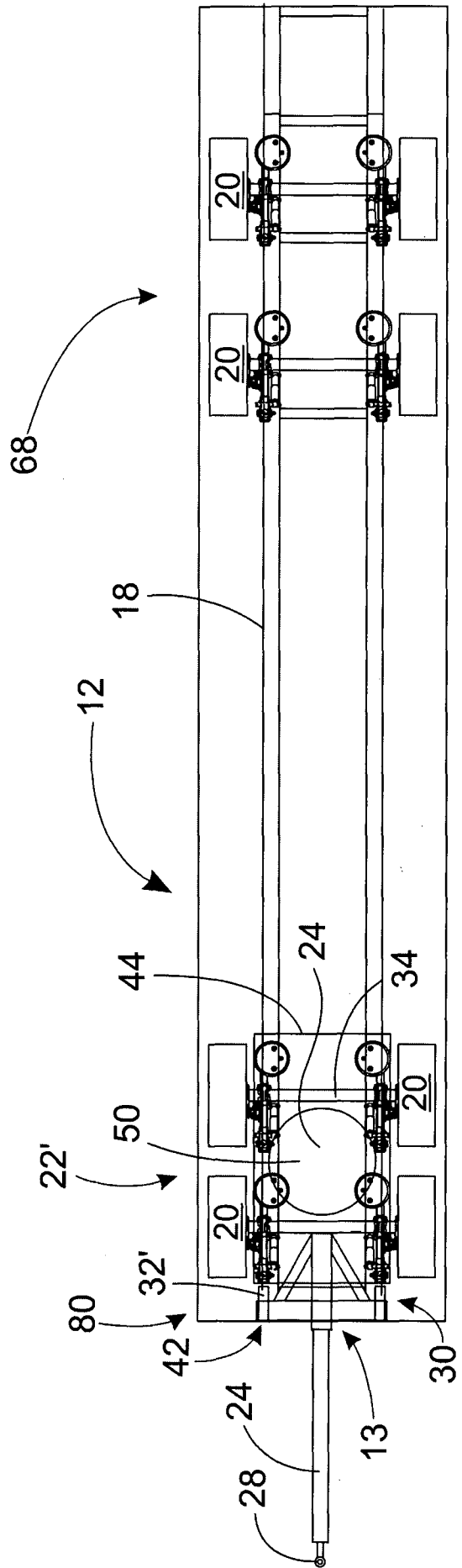


Fig. 7b



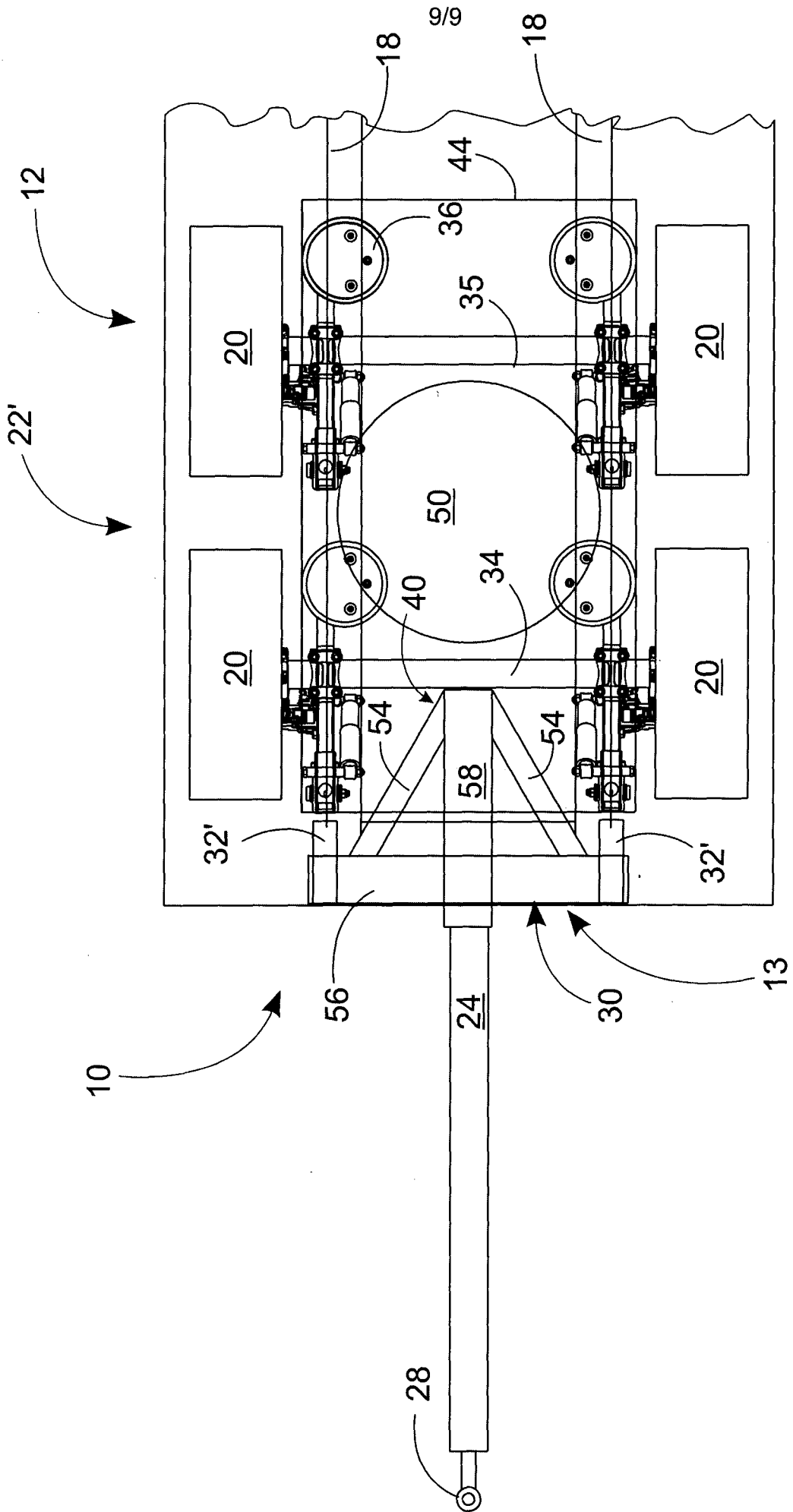


Fig. 8b

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2012/050459

## A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC: B60D, B62D

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

FI, SE, NO, DK

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

EPO-Internal, WPI

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	NL 1032869 C1 (CHR VAN DEN HEUVEL & ZONEN B V) 15 May 2008 (15.05.2008) figures 1 and 2; page 2, lines 16-22	1-8
A	GB 2168021 A (CARTWRIGHT FREIGHT SYSTEMS LIM) 11 June 1986 (11.06.1986) figure 2; page 1, line 119 - page 2, line 14	1-8

 Further documents are listed in the continuation of Box C.
  See patent family annex.

\* Special categories of cited documents:

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"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

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"&amp;" document member of the same patent family

Date of the actual completion of the international search

18 September 2012 (18.09.2012)

Date of mailing of the international search report

20 September 2012 (20.09.2012)

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**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.  
PCT/FI2012/050459

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
NL 1032869 C1	15/05/2008	None	
.....			
GB 2168021 A	11/06/1986	None	
.....			

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.

**B60D 1/167** (2006.01)

**B60D 1/155** (2006.01)

**B62D 53/00** (2006.01)

**B60P 1/64** (2006.01)