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(54) **Concrete transport vehicle and method for transporting concrete from a concrete batching plant to a placement point on a construction site**

(57) A concrete transport vehicle and a method for transporting concrete from a concrete batching plant to placement point on a construction site. The vehicle comprises an agitator (1); a pumping apparatus (3) comprising a feed hopper (4), a concrete pump (5) and a first pipeline (6); and a knuckle boom (7) provided with a second pipeline (8), which can be connected to the first pipeline (6) to convey concrete to a placement point.

The concrete transport vehicle comprises a third pipeline (9), one end of which can be connected to the first pipeline (6) and whose other end extends to a point close to the charge and discharge hole (2) of the agitator (1), and valve means (10) for passing concrete optionally from the first pipeline (6) into the second pipeline (8) of the knuckle boom (7) or from the first pipeline (6) into the third pipeline (9) leading into the agitator (1).

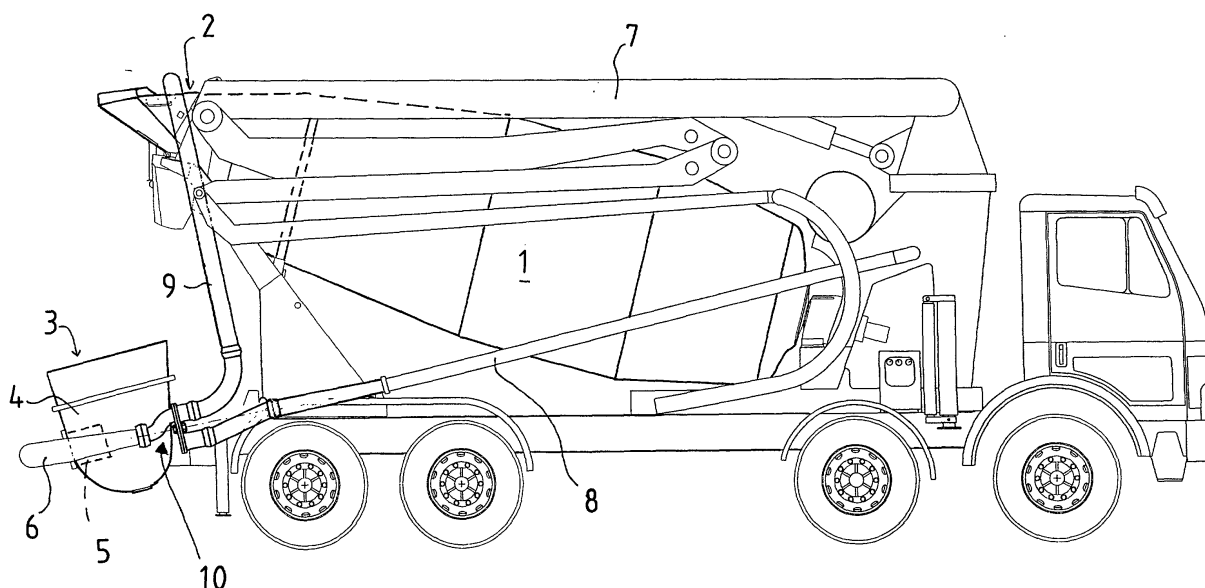


Fig. 1

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Description

[0001] The present invention relates to a concrete transport vehicle as defined in the preamble of claim 1. Moreover, the invention relates to a method as defined in the preamble of claim 11.

[0002] A concrete transport vehicle is known in prior art. The vehicle comprises a rotating agitator provided with a charge and discharge hole in its upper rear part, through which concrete can be brought into the agitator and discharged from the agitator. Provided in the rear part of the vehicle is a pumping apparatus. The pumping apparatus comprises an upwardly open feed hopper disposed below the charge and discharge hole to receive concrete. The pumping apparatus further comprises a concrete pump for pumping concrete from the feed hopper. In addition, the pumping apparatus comprises a first pipeline, into which the concrete pump pumps the concrete. The concrete transport vehicle also comprises a knuckle boom or the like, which is provided with a second pipeline, which can be connected to the output of the pumping apparatus, i.e. to the first pipeline so that the concrete can be discharged to the placement point via the second pipeline.

[0003] The transportation of concrete from a batching plant to a placement point is usually implemented using one concrete transport vehicle provided with a pumping apparatus and a knuckle boom as described above, hereinafter called first concrete transport vehicle (often also called "combination pump" in professional terminology), and one or more second concrete transport vehicles, which are only used for transporting concrete from the concrete batching plant to the first concrete transport vehicle, which remains stationary at the construction site, to replenish its agitator.

[0004] In the prior-art method, the agitator of the first concrete transport vehicle is filled with concrete at the concrete batching plant. The first concrete transport vehicle is driven to the construction site, to a location near the placement point where the concrete is to be poured. The knuckle boom is extended so that a second pipeline connected to it reaches the placement point. From the agitator of the first concrete transport vehicle, concrete is supplied into the feed hopper of the pumping apparatus, from where the concrete is pumped by the pumping apparatus via the second pipeline of the knuckle boom to the placement point. Meanwhile, at the concrete batching plant, the agitator of a second concrete transport vehicle is filled with concrete, and the second concrete transport vehicle is driven to a place near the first concrete transport vehicle. From the agitator of the second concrete transport vehicle, the concrete is transferred into the agitator of the first concrete transport vehicle.

[0005] For this transfer, two different methods have been used so far.

[0006] In one method, the transfer is effected using a belt conveyor mounted in an inclined position, onto

which the second concrete transport vehicle supplies concrete, which is conveyed on the belt conveyor up through the charge hole of the first concrete transport vehicle into the agitator. The use of a belt conveyor involves great difficulties because the belt and its immediate surroundings get soiled with concrete. The belt conveyor is a heavy device that is difficult to handle.

[0007] In the other method, the concrete is transferred from one vehicle to the other using the pumping apparatus of the first concrete transport vehicle, into whose feed hopper the second concrete transport vehicle discharges its concrete load, and the concrete is pumped by the pumping apparatus into the agitator of the first concrete transport vehicle via the second pipeline of its own knuckle boom. For this purpose, the knuckle boom already extended to the placement point has to be re-adjusted into a new position so that the end of the second pipeline reaches the charge hole of the agitator. Especially when working in low spaces, e.g. inside buildings, this may even be impossible. In any case, readjusting the knuckle boom position is a time-consuming and difficult task. Any extra time expenditure arising in connection with the transportation and casting of concrete leads to increased costs in accordance with the current pricing basis.

[0008] The object of the invention is to eliminate the above-mentioned drawbacks.

[0009] A specific object of the invention is to disclose a concrete transport vehicle and a method that will eliminate the need to move the knuckle boom away from the placement point when concrete is to be transferred from a vehicle transporting concrete into a pumping vehicle.

[0010] A further object of the invention is to disclose an accessory for a concrete transport vehicle which is considerably more favorable in price than the prior-art belt conveyor solution and which can be easily mounted on new as well as existing concrete transport vehicles.

[0011] The concrete transport vehicle of the invention is characterized by what is presented in claim 1. The method of the invention is characterized by what is presented in claim 11.

[0012] According to the invention, the concrete transport vehicle comprises a third pipeline, one end of which can be connected to the first pipeline and whose other end extends to a point close to the charge and discharge hole of the agitator, and valve means for passing concrete optionally from the first pipeline into the second pipeline of the knuckle boom or from the first pipeline into the third pipeline, which leads into the agitator.

[0013] According to the invention, when the concrete brought by the transporting second concrete transport vehicle is being transferred by means of the pumping apparatus of the first concrete transport vehicle into the agitator of the first concrete transport vehicle, the knuckle boom is held stationary in the position it was in, i.e. in the position extended to the placement point, without changing its position. The flow of concrete is directed by the valve means from the first pipeline of the pumping

apparatus into the third pipeline, which brings the concrete directly via the charge and discharge hole into the aforesaid agitator. When the pumping of concrete to the placement point is continued after the replenishment, the valve means are set into a new position so as to allow a flow of concrete from the first pipeline into the second pipeline of the knuckle boom.

[0014] The invention provides the advantage that, using simple valve means and a third pipeline, it eliminates the need for readjustment and turning of the knuckle boom, thus saving time and labor. In addition, working in low spaces is made possible. The third pipeline provides a considerably shorter transfer route for the concrete than the second pipeline in the knuckle boom, so this is another factor contributing towards reducing the transfer time.

[0015] Other advantages and preferred characteristics of the invention appear from the following description of examples of embodiments and from the sub-claims.

[0016] In the following, the invention will be described in detail by the aid of examples with reference to the attached drawings, wherein

Fig. 1 presents a side view of an embodiment of the concrete transport vehicle of the invention,

Fig. 2 presents a partially sectioned view of a first embodiment of a change valve of the concrete transport vehicle, with the change valve in a first position,

Fig. 3 presents a section along line III-III in Fig. 2, Fig. 4 presents the embodiment in Fig. 2 with the change valve in a second position,

Fig. 5 presents another embodiment of the change valve,

Fig. 6 presents a third embodiment of the valve means.

[0017] Fig. 1 presents a concrete transport vehicle comprising an agitator 1. The agitator 1 is of a conventional type, i.e. it has mixing means inside it, which mix the concrete during transport as the agitator is rotated in one direction. When the agitator is rotated in the other direction, the mixing means inside it operate on the principle of the Archimedean screw, so that the concrete is removed from the agitator via the aforesaid charge and discharge hole 2, which is located in the upper rear part of the agitator 1 and through which concrete can be supplied into the agitator and discharged from it. Mounted in the rear part of the vehicle is a pumping apparatus 3. The pumping apparatus 3 comprises an upwardly open feed hopper 4, which is placed below the charge and discharge hole 2 to receive concrete, which is either fed into the feed hopper from the vehicle's own agitator 1 or supplied into it from an external source, such as a second concrete transport vehicle. The pumping apparatus further comprises a concrete pump 5 for pumping concrete from the feed hopper. The concrete pump 5 feeds

concrete into the first pipeline 6.

[0018] The vehicle further comprises a knuckle boom 7, which in Fig. 1 has been folded down into a transport position. The knuckle boom 7 can be turned and extended so that its end reaches a point at a distance from the vehicle. The knuckle boom 7 is provided with a second pipeline 8, through which the concrete supplied via the first pipeline 6 can be passed to the placement point.

[0019] The concrete transport vehicle is provided with a third pipeline 9, which in the figure is in a substantially vertical position and whose one end can be connected to the first pipeline 6 while the other end reaches a point near the charge and discharge hole 2 of the agitator 1. The concrete transport vehicle further comprises valve means 10 for directing the concrete optionally from the first pipeline 6 into the second pipeline 8 of the knuckle boom 7 and further to the placement point, or from the first pipeline 6 into the third pipeline 9 and further directly into the agitator 1. The operation of the valve means 10 is such that the valve means 10 close the flow path into the third pipeline 9 when the flow path between the first pipeline 6 and the second pipeline 8 is open. Correspondingly, the valve means 10 close the flow path into the second pipeline 8 when the flow path between the first pipeline 6 and the third pipeline 9 is open.

[0020] Fig. 2 shows an embodiment of the valve means, which is a rotary-type change valve 10. The change valve 10 comprises a rotary shutter plate 11 comprising a first port 12, which has been arranged to communicate with the first pipeline 6, and a solid shutter part 13. The shutter plate 11 is mounted opposite to a fixed port plate 14. The port plate 14 comprises a second port 15, which communicates with the second pipeline 8, and a third port 16, which communicates with the third pipeline 9. The shutter plate 11 can be rotated between two positions I, II.

[0021] In Fig. 2, the valve 10 is in the first position I, where the first port 12 is in alignment with the second port 15 while the shutter part 13 closes the third port 16. In this situation, concrete flows from the first pipeline 6 coming from the pumping apparatus into the second pipeline 8 of the knuckle boom 7.

[0022] In Fig. 4, the valve 10 is in the second position II, where the first port 12 is aligned with the third port 16 while the shutter part 13 closes the second port 15. In this situation, concrete flows from the first pipeline 6 coming from the pumping apparatus and through the third pipeline 9 into the agitator.

[0023] In the embodiment presented in Fig. 2 - 4, a rotary tube 17 is connected by one end to the first pipeline 6 via a joint permitting rotation about its center axis L, and attached by the other end to the shutter plate 11 so that it is in alignment with the first port 12 at a distance of radius r from said center axis. The shutter plate 11 is mounted on the fixed port plate 14 with a bearing permitting rotation about said center axis. The second port 15 and the third port 16 are located in the port plate 14 at said distance r from the center axis.

[0024] Fig. 3 visualizes the circumstance that the rotary tube 17 and the shutter plate 11 can be rotated between positions I and II by a power means 20, which may be e.g. a hydraulic cylinder. It is obvious that the power means may consist of any known type of power means. The valve 10 may alternatively be a manually operated type, i.e. a valve rotated by hand.

[0025] Fig. 5 shows a slide-type valve 10. This change valve 10, too, comprises a shutter plate 21, which comprises a first port 22, arranged to communicate with the first pipeline 6, and a solid shutter part 23. The fixed port plate 24 comprises a second port 25, which communicates with the second pipeline 8, and a third port 26, which communicates with the third pipeline 9. The shutter plate 21 can be moved between two positions I, II. In the first position I, depicted in Fig. 5 with solid lines, the first port 22 is in alignment with the second port 25 while the shutter part 23 closes the third port 26. In the second position II, depicted with dotted broken lines, the first port 22 is in alignment with the third port 26 while the shutter part 23 closes the second port 25. Furthermore, the valve 10 comprises a movable swivel tube 18, one end of which is swivellably connected to the first pipeline 6 via a flexible joining element 19, which may consist of a tube formed from rubber or elastic plastic. The other end of the swivel tube 18 is attached to the shutter plate 21 so that it is in alignment with the first port 22. The shutter plate 21 has been arranged to be linearly movable between a first position I and a second position II. The motion of the shutter plate 21 may be implemented using a power means (not shown), e.g. a hydraulic cylinder. The power means may also consist of any known type of power means. The valve 10 may also be a manually operated type.

[0026] If the diameter of the first pipeline 6 is larger than the diameter of the second pipeline 8 and the third pipeline 9, then the rotary tube and/or the swivel tube may simultaneously function as a reducing pipe (not shown in the drawings).

[0027] Fig. 6 presents diagrammatic view of a further embodiment, in which the valve means 10 are implemented using two shutter valves 27, one of which is mounted in the second pipeline 8 and the other in the third pipeline 10. By alternately opening and closing the shutter valves 27, the concrete can be directed to the desired place.

[0028] In the method for transporting concrete from a concrete batching plant to a placement point on a construction site, the following procedure is observed:

- a) the agitator of a first concrete transport vehicle (as in Fig. 1) is filled with concrete at a concrete batching plant, said vehicle being equipped with a pumping apparatus comprising a feed hopper, a concrete pump and a first pipeline; a knuckle boom provided with a second pipeline; and an agitator provided with a charge and discharge hole,
- b) the first concrete transport vehicle is driven to the

construction site, to a location near the placement point,

c) the knuckle boom is extended so that its second pipeline reaches the placement point,

d) using the pumping apparatus of the first concrete transport vehicle, concrete supplied from the agitator to the pumping apparatus is pumped via the second pipeline of the knuckle boom to the placement point,

e) the agitator of a second concrete transport vehicle provided with an agitator is filled with concrete,

f) the second concrete transport vehicle is driven to a place close to the first concrete transport vehicle, and

g) using the pumping apparatus of the first concrete transport vehicle, the concrete is transferred from the agitator of the second concrete transport vehicle into the agitator of the first concrete transport vehicle, and

steps d) - g) are repeated until the placement of concrete has been completed.

[0029] During step g), the knuckle boom is held in the position extended to the placement point as in step c), and the flow of concrete is directed by the valve means from the first pipeline of the pumping apparatus into the third pipeline, which conveys the concrete directly via the charge and discharge hole into the agitator, and after step g) before step d), the valve means are set so as to allow the concrete to flow from the first pipeline into the second pipeline of the knuckle boom.

[0030] The invention is not limited to the examples of its embodiments described above; instead, many variations are possible within the scope of the inventive idea defined in the claims.

Claims

1. Concrete transport vehicle, comprising

- an agitator (1) having in its upper rear part a charge and discharge hole (2), through which concrete can be supplied into the agitator and discharged from the agitator,
- a pumping apparatus (3) mounted in the rear part of the vehicle and comprising
 - an upwardly open feed hopper (4) located below the charge and discharge hole (2) to receive concrete,
 - a concrete pump (5) for pumping concrete from the feed hopper, and
 - a first pipeline (6) for receiving concrete from the concrete pump, and
- a knuckle boom (7) or the like, provided with a second pipeline (8), which can be connected to

- the first pipeline (6) to convey concrete to a placement point, **characterized in that** the concrete transport vehicle comprises
- a third pipeline (9), one end of which can be connected to the first pipeline (6) and whose other end extends to a point close to the charge and discharge hole (2) of the agitator (1), and
 - valve means (10) for passing concrete optionally from the first pipeline (6) into the second pipeline (8) of the knuckle boom (7) or from the first pipeline (6) into the third pipeline (9) leading into the agitator (1).
2. Concrete transport vehicle according to claim 1, **characterized in that** the valve means (10) have been arranged to close the flow path into the third pipeline (9) when the flow path between the first pipeline (6) and the second pipeline (8) is open.
3. Concrete transport vehicle according to claim 1 or 2, **characterized in that** the valve means (10) have been arranged to close the flow path into the second pipeline (8) when the flow path between the first pipeline (6) and the third pipeline (9) is open.
4. Concrete transport vehicle according to any one of claims 1 - 3, **characterized in that** the valve means comprise a change valve (10), such as a three-way change valve.
5. Concrete transport vehicle according to claim 4, **characterized in that** the change valve (10) comprises
- a movable shutter plate (11, 21) comprising a first port (12, 22) arranged to communicate with the first pipeline (6), and a solid shutter part (13, 23), and
 - a fixed port plate (14, 24) having a second port (15, 25) arranged to communicate with the second pipeline (8) and a third port (16, 26) arranged to communicate with the third pipeline (9), said ports being disposed adjacently to each other,
- and that the shutter plate (11, 21) can be moved between two positions (I, II), a first position (I), where the first port (12, 22) is in alignment with the second port (15, 25) while the shutter part (13, 23) closes the third port (16, 26), and a second position (II), where the first port (12, 22) is in alignment with the third port (16, 26) while the shutter part (13, 23) closes the second port (15, 25).
6. Concrete transport vehicle according to claim 5, **characterized in that** the change valve (10) comprises a rotary tube (17), one end of which is connected to the first pipeline (6) so as to be rotatable about its center axis (L) while the other end is connected to the shutter plate (11) so that it is in alignment with the first port (12) at a distance or radius (r) from said center axis; that the shutter plate (11) is mounted on the fixed port plate (14) with a bearing permitting rotation about said center axis; and that the second port (15) and the third port (16) are disposed at a distance of radius (r) from the center axis in the port plate (14).
7. Concrete transport vehicle according to claim 5, **characterized in that** the change valve (10) comprises a movable swivel tube (18), one end of which is swivelably connected to the first pipeline (6) while the other end is connected to the shutter plate (21) so that it is in alignment with the first port (22); and the shutter plate (21) has been arranged to be substantially linearly movable between the first position (I) and the second position (II).
8. Concrete transport vehicle according to claim 7, **characterized in that** the swivel tube (18) is connected to the first pipeline (6) with a flexible joining element (19).
9. Concrete transport vehicle according to claim 7 or 8, **characterized in that** the diameter of the first pipeline (6) is larger than the diameter of the second pipeline (8) and the third pipeline (9); and that the diameter of the first end of the rotary (17) and/or swivel tube (18) corresponds to the diameter of the first pipeline (6) while the diameter of its second end corresponds to the diameter of the second pipeline (8) and the third pipeline (9), the rotary tube and/or swivel tube functioning as a reducing pipe between said pipelines.
10. Concrete transport vehicle according to any one of claims 5 - 9, **characterized in that** the change valve (10) comprises a power means (20), such as a hydraulic cylinder, for moving the shutter plate (11, 21) between the first position (I) and the second position (II).
11. Method for transporting concrete from a concrete batching plant to a placement point on a construction site, in which method
- a) the agitator of a first concrete transport vehicle, which is equipped with a pumping apparatus comprising a feed hopper, a concrete pump and a first pipeline; a knuckle boom provided with a second pipeline; and an agitator provided with a charge and discharge hole, is filled with concrete at a concrete batching plant,
 - b) the first concrete transport vehicle is driven to the construction site, to a place near the placement point,

c) the knuckle boom is extended so that its second pipeline reaches the placement point,
d) using the pumping apparatus of the first concrete transport vehicle, concrete supplied from the agitator to the pumping apparatus is pumped via the second pipeline of the knuckle boom to the placement point,
e) the agitator of a second concrete transport vehicle provided with an agitator is filled with concrete,
f) the second concrete transport vehicle is driven to a place close to the first concrete transport vehicle, and
g) using the pumping apparatus of the first concrete transport vehicle, the concrete is transferred from the agitator of the second concrete transport vehicle into the agitator of the first concrete transport vehicle, and
steps d) - g) are repeated until the placement of concrete is completed, **characterized in that**, during step g), the knuckle boom is held in the position extended to the placement point as in step c), and the flow of concrete is directed using the valve means from the first pipeline of the pumping apparatus into the third pipeline, which conveys the concrete directly via the charge and discharge hole into the agitator, and after step g) before step d), the valve means are set so as to allow the concrete to flow from the first pipeline into the second pipeline of the knuckle boom.

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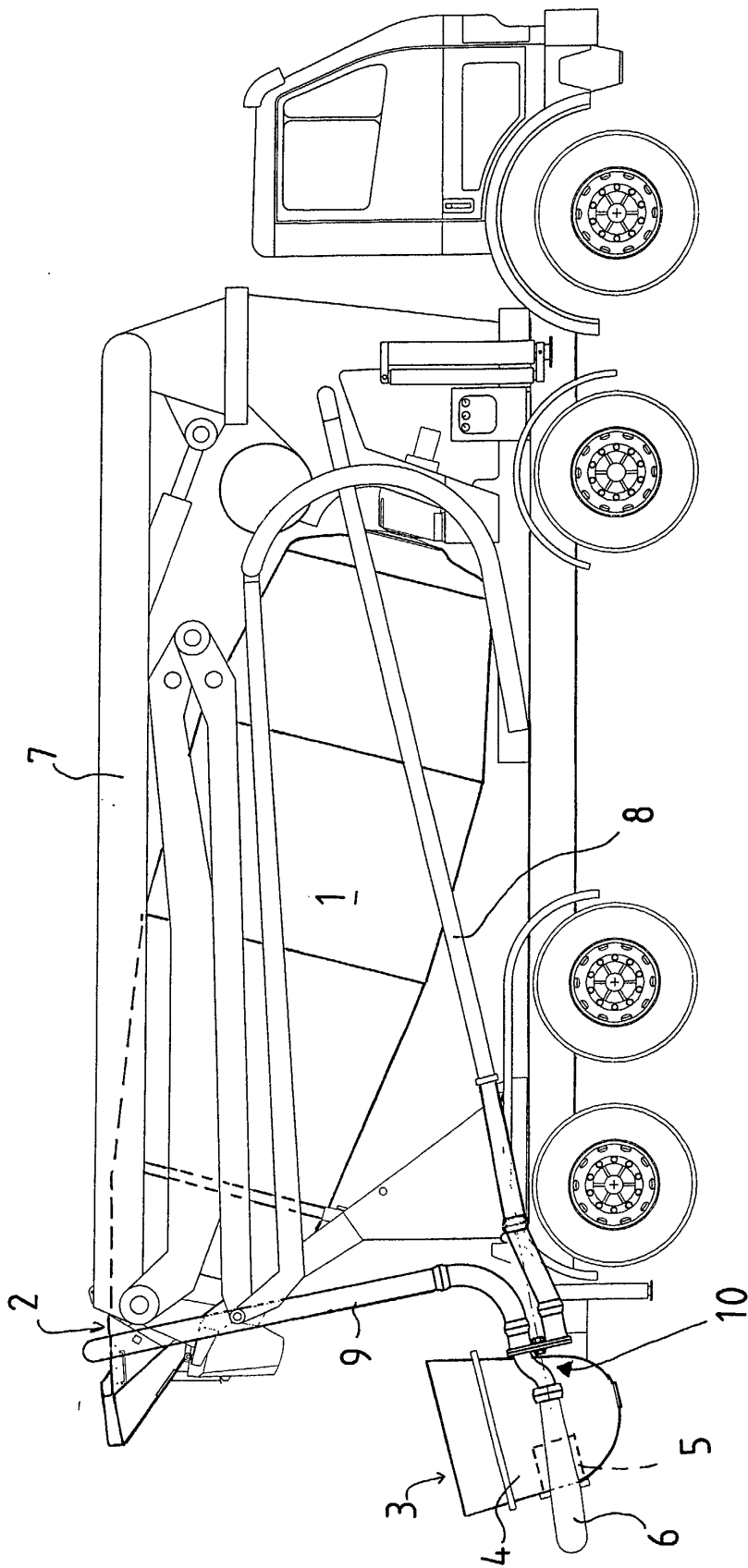
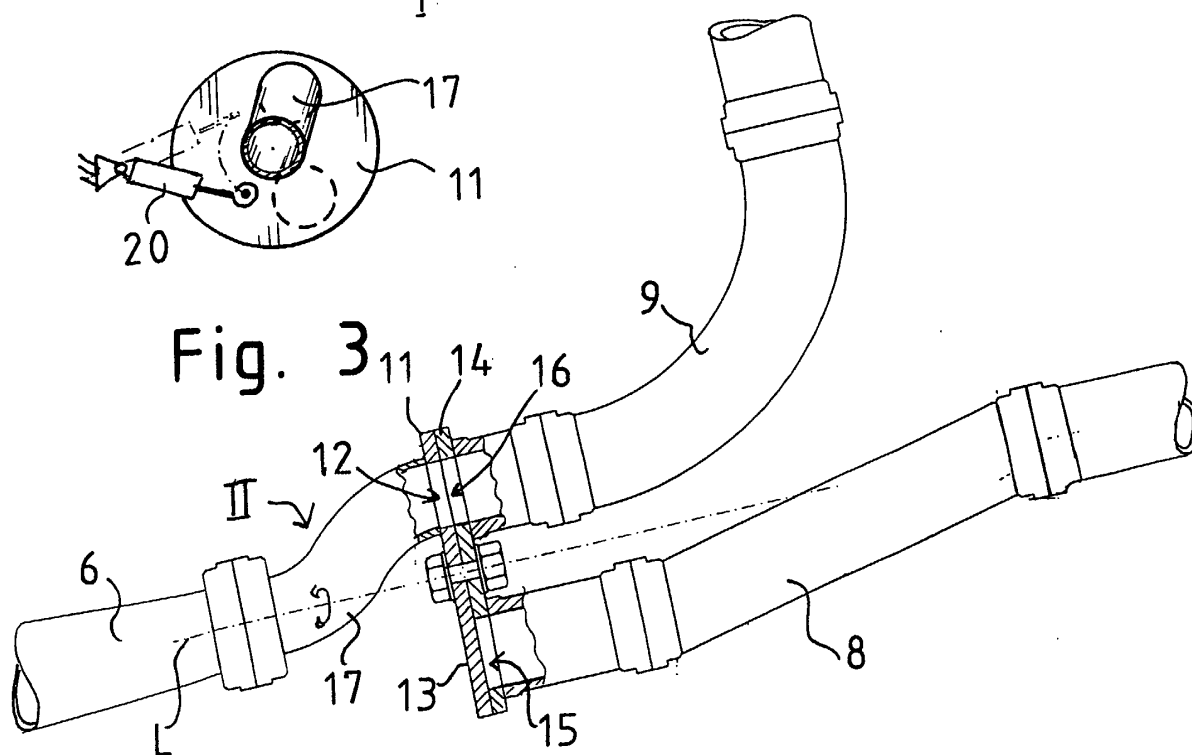
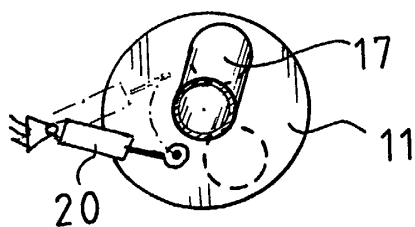
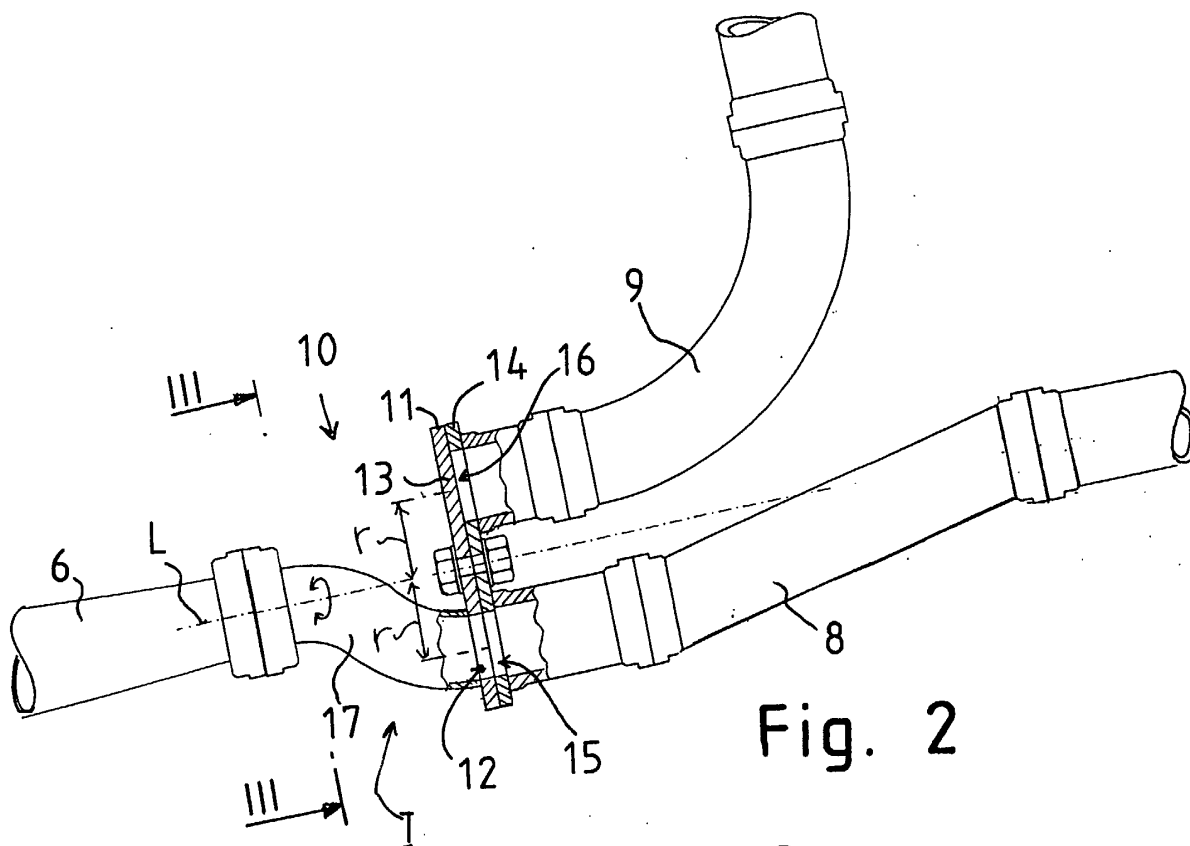


Fig. 1



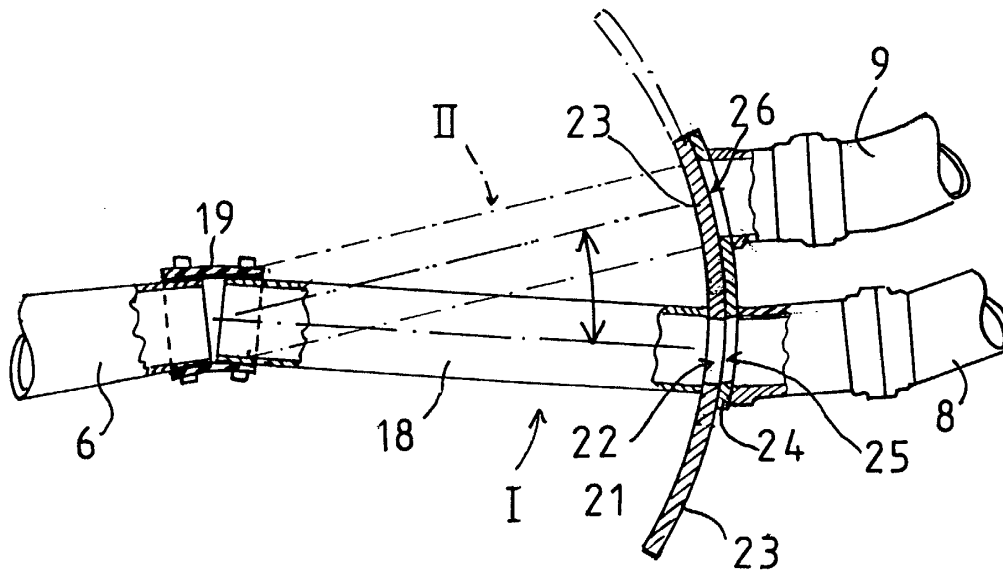


Fig. 5

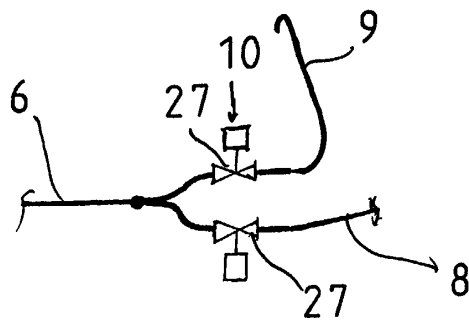


Fig. 6