

## Description

### MULTIFUNCTION CONNECTOR

#### Technical Field

[01] The present invention relates to a multifunction connector for a vehicle, or a vehicle trailer, or a system, or a machine, or a device (e.g. an agricultural, biogas, woodchip or manure technology system for stationary/mobile operation) for connecting and disconnecting connection members of lines. Said lines are, in particular, electrical lines and/or hydraulic lines and/or pneumatic lines. The present invention further relates to an assembly unit comprising a receiving member and a parallelogram mechanism, as well as to a receiving member.

#### Background

[02] Besides a mechanical connection between a trailer and a towing vehicle, additionally, an electrical connection is required, for example, for transmitting electric current for illuminating devices of the trailer. As the electrical connection has to be disconnected when decoupling the trailer from the towing vehicle, the electrical connection of towing vehicle side and trailer side electrical lines is usually implemented by plugs.

[03] In addition to an electrical connection, for example, in particular in agricultural tractors, also hydraulic or pneumatic connections, or connections for water or fertilizer lines may be required between the towing vehicle and the trailer; said connections are also implemented by suitable connection members between the corresponding towing vehicle side and trailer side hoses. Depending on the field of application, a number of connection members are used per towing vehicle and trailer, respectively, all of which members have to be connected each time the trailer is coupled to the towing vehicle, and all of which members have to be disconnected each time the trailer is decoupled from the towing vehicle,

thus making this process labor-intensive. Moreover, in particular if lighting is poor, there is the risk that connection members of different lines are interchanged, and that the connection members of two lines that do not belong together are connected.

[04] EP 0 522 493 B2 discloses a quick coupling for simultaneously coupling or decoupling connections of a plurality of connector plugs and/or couplings. The quick coupling comprises two support plates on which sleeve parts and plug parts of hydraulic, pneumatic and/or electrical energy transmitting systems are provided. The support plates are pressed together by means of a tension lever, in order to establish a connection between the plugs and/or couplings. In case of hydraulic couplings, spring-loaded flat seal couplings without ball locking are used. The relative arrangement of the support plates with regard to each other is determined by guide pins and associated guide openings which are formed in the support plates. DE 10 2017 200 743 A1 discloses a coupling mechanism, by means of which two connection blocks are moved between a receiving and a coupling position. The coupling mechanism comprises rotatable links and roll pins, which roll pins are guided in cam slits of the rotatable links.

[05] EP 0 787 905 B1 discloses a unit for distributing a pressure medium, which unit consists of an intermediate plate and a hydraulic block. The intermediate plate and the hydraulic block respectively comprise a polished surface. In the connected state of the intermediate plate and the hydraulic block, the polished surfaces abut each other. Connecting pieces, which can be inserted into bores formed in the hydraulic block, protrude from the intermediate plate. The intermediate plate is fixedly connected with the hydraulic block by means of screws, such that the polished surface of the intermediate plate is firmly pressed against the polished surface of the hydraulic block, thus achieving a sealing effect between the intermediate plate and the hydraulic block.

[06] EP 2 476 941 B1 discloses a device for simultaneously coupling a plurality of hydraulic or electrical lines. The device comprises two plate-like members, each of the members being provided with couplings that are complementary to each other. The complementary couplings of the two plate-like

members are connected by means of a lever, by means of which the two plate-like members are pressed together.

[07] WO 2015/086648 A1 discloses a further quick coupling for a number of hydraulic, electric and/or pneumatic lines, which coupling comprises two plates holding a plurality of couplings. The two plates and the couplings held by the plates are connectable by means of a lever. Partially, the couplings are specific couplings. Instead of connecting the two plates with each other, also single couplings may be connected with couplings of one of the two plates, in case that connections via the further couplings are not required for a specific application.

[08] In the above devices, a safe and tight connection of the complementary couplings is achieved by plates that are closely attached to one another and pressed together, respectively. In order to assure safe guiding of the plates when connecting the plates, and in order to avoid tilting of the plates, guiding members may be required. In some cases, plugs and connection members for the electric, hydraulic and/or pneumatic lines, respectively, which are purpose-built for the device, have to be used, whereas the use of commercial plugs and connection members is often not possible due to the specific structure of the devices.

[09] In the unit disclosed by EP 0 787 905 B1, the connection between the intermediate plate and the hydraulic block is effected by means of screws. Tightening and loosening the screws when connecting and disconnecting the intermediate plate and the hydraulic block requires effort and time.

[10] One problem underlying the invention is to provide a multifunction connector, which allows for simple, quick and secure connection and disconnection of towing vehicle side and trailer side electrical lines and/or hydraulic/pneumatic lines by using commercial connection members, in particular plugs and sockets and/or couplings with interlocking plug and sleeve parts.

#### Summary of the Invention

[11] According to one aspect of the present disclosure, a multifunction connector for a vehicle or vehicle trailer for connecting and disconnecting connection members of lines, in particular electrical lines and/or hydraulic lines

and/or pneumatic lines, comprises a first receiving member for receiving at least one first connection member, a second receiving member for receiving at least one second connection member, which is connectable with the first connection member, and a parallelogram mechanism (moving mechanism). The parallelogram mechanism is configured to move the second receiving member substantially linearly along a connection direction of the first connection member and the second connection member, between an opened state in which the first connection member and the second connection member are disconnected from each other, and a closed state, in which the first connection member and the second connection member are connected with each other, relatively to the first receiving member. In this context, the term “substantially linearly” means that the movement is effected approximately along a straight line, e.g. in horizontal direction, wherein a minor deviation from the straight line, e.g. a deviation in the vertical direction of up to 10 mm or up to 5 mm or up to 2 mm or up to 1 mm is possible. In the horizontal direction, a deviation of up to 10 mm or up to 5 mm or up to 2 mm or up to 1 mm is possible.

[12] Generally, a parallelogram mechanism has to be understood as, for example, a parallelogram guiding comprising two guides which are guided in parallel with each other. By means of these two guides, a first member and a second member are moved relatively to each other, without changing their relative orientation, i.e. without being twisted out of alignment. Each of the two guides is rotatably connected with the first member at a first pivot point, and is rotatably connected with the second member at a second pivot point, wherein the axes of rotation are in parallel with each other. The distances between the first pivot point and the second pivot point are equal for the two guides. Moreover, the distance between the first pivot points equals the distance between the second pivot points. The pivot points are located in a plane perpendicular to the axes of rotation of the pivot points, and form the corners of a parallelogram, wherein the two guides form two opposed sides of the parallelogram. The parallelogram may be sheared by synchronously pivoting the guides.

[13] In other words, by means of a parallelogram mechanism, a member attached to a lever and dual arm, respectively, can be held in the initial inclination angle (in the plane of the lever path) also when moving along the path of the lever and the dual arm, respectively. That is, the angular posture of the member is maintained during movement. Corresponding to the definition of a parallelogram, two guides of equal length are used in a parallelogram mechanism, which guides are supported on axes in their load and pivot points and, on their other ends, are connected with each other via a further guide in the length of the lever arm (cf. Wikipedia article “parallelogram guiding”).

[14] In the multifunction connector, by means of the parallelogram mechanism, the first receiving member and the second receiving member are moved substantially linearly along the connection direction of the first connection member and the second connection member, i.e. in the direction in which the first connection member and the second connection member are connected with each other (e.g. the direction in which two complementary plugs or hose couplings are fitted together), relatively to each other, without being tilted or twisted. Thus, problems in connecting the connection members as, for example, canting, are avoided. The use of additional guide members as, for example, guide pins is not necessarily required. By arranging the connection members on the receiving members, a fast, secure and, in particular, non-interchangeable parallel and simultaneous connecting and disconnecting and coupling and decoupling, respectively, of a plurality of connection members is possible. Unintended interchanging of connection members is avoided as the connection members can be fixedly attached to the receiving members.

[15] A load application unit for shearing of the parallelogram mechanism, i.e. for a transition from the opened state to the closed state and vice versa, may be provided to the parallelogram mechanism. The load application unit may be, for example, a hand lever or another mechanical, electrical, pneumatic or hydraulic device.

[16] The first receiving member is configured to receive at least one first connection member, i.e. one or a plurality of first connection members. The

second receiving member is configured to receive at least one second connection member, i.e. one or a plurality of second connection members.

[17] The parallelogram mechanism may comprise a holder for attaching the second receiving member, a first side member (first guide), which connects the first receiving member and the holder with each other, and which is pivotable in a first plane in parallel with the connection direction of the first connection member and the second connection member relatively to the first receiving member and the holder, and a second side member (second guide), which connects the first receiving member and the holder with each other, and which is pivotable in a second plane, which is identical with or in parallel with the first plane, relatively to the first receiving member and the holder. The second side member can be shifted relatively to the first side member in the connection direction of the first connection member and the second connection member.

[18] The first side member may be hingedly connected with the first receiving member at a first connection point, and may be hingedly connected with the holder at a second connection point. The second side member may be hingedly connected with the first receiving member at a third connection point, and may be hingedly connected with the holder at a fourth connection point. When viewed in a direction perpendicular to the first plane and the second plane, the connection points of the first side member and the second side member with the first receiving member and the holder may be arranged at the corner points of a parallelogram.

[19] The first side member may be an elongate component, e.g. a flat iron. A first end of the first side member in the longitudinal direction of the first side member may be hingedly connected with the first receiving member, and a second end of the first side member in the longitudinal direction may be hingedly connected with the holder. The second side member may be an elongate component, e.g. a flat iron. A first end of the second side member in the longitudinal direction of the second side member may be hingedly connected with the first receiving member, and a second end of the second side member in the longitudinal direction may be hingedly connected with the holder. The

longitudinal direction of the first side member may be substantially in parallel with the longitudinal direction of the second side member.

[20] The parallelogram mechanism may further comprise a rotary member attached to the first receiving member and rotatable about a first axis, which is perpendicular to the first plane and the second plane, relatively to the first receiving member, and an intermediate member, which is hingedly connected with the first side member and hingedly connected with an eccentric portion of the rotary member. The intermediate member may be connected with the first side member such that the first side member is pivoted in the first plane relatively to the first receiving member by a movement associated with a rotation of the rotary member about the first axis.

[21] The intermediate member and the rotary member may form a knee lever mechanism, the dead center of which is exceeded on transition between the opened state and the closed state. This ensures that the multifunction connector is not unintendedly opened, e.g. due to vibrations. The intermediate member and the rotary member do not necessarily have to form a knee lever mechanism. Unintended opening of the multifunction connector may, for example, also be prevented by a lock.

[22] The parallelogram mechanism may comprise a first sub-mechanism and a second sub-mechanism, which are arranged displaced by a third distance with respect to each other in a direction perpendicular to the first plane and the second plane. The third distance may be, for example, at least 10 cm, or at least 20 cm, or at least 30 cm. Each of the first sub-mechanism and the second sub-mechanism may comprise a first side member and a second side member.

[23] Each of the first sub-mechanism and the second sub-mechanism may comprise an intermediate member and a rotary member. Each of the first sub-mechanism and the second sub-mechanism may comprise a holder. The first sub-mechanism and the second sub-mechanism may share one holder.

[24] The rotary member of the first sub-mechanism and the rotary member of the second sub-mechanism may be connected with each other via a shaft

extending along the first axis, such that they are integrally rotatable about the first axis.

[25] The parallelogram mechanism may comprise a receiver for a load application device, and the rotary member may be rotated about the first axis by means of the load application device. The load application device may be a hand lever or another mechanical adjustment device, or may be an electrical, pneumatic or hydraulic adjustment device.

[26] The first receiving member may be configured to receive at least two first connection members. Analogously, a second receiving member may be used, which is configured to receive at least two second connection members, wherein the connection directions of the first connection members and the second connection members are oriented in parallel with each other. Specifically, the first connection members are oriented coaxially with regard to the respectively opposed complementary second connection members, such that the first and second connection members are connected with each other when the second receiving member approaches the first receiving member. For example, two complementary plugs are fitted together.

[27] In such a structure, a plurality of connection members can be easily and quickly connected with each other and disconnected from each other, respectively, in parallel or simultaneously. The number of second connection members may correspond to the number of first connection members or may be lower than the number of first connection members.

[28] The first receiving member may comprise a first plate in which at least one opening for receiving the at least one first connection member is formed. The second receiving member may comprise a second plate in which at least one second opening for receiving the at least one second connection member is formed.

[29] The first plate and the second plate may be pressed together in the closed state of the multifunction connector. Alternatively, in the closed state, a first gap amounting to at least 1 mm or at least 1 cm may exist between the first plate and the second plate.

[30] The first receiving member or the holder may comprise a tubular sleeve oriented in parallel with the connection direction of the first connection member and the second connection member, and the respectively other one of the first receiving member and the holder may comprise a bolt oriented in parallel with the connection direction of the first connection member and the second connection member, and extending through the sleeve. Specifically, the sleeve may be attached to the first receiving member and the bolt may be attached to the holder. By means of the bolt, which extends through the sleeve, an additional guiding of the movement of the parallelogram mechanism and, thus, a stabilization of the alignment between the first receiving member and the holder and the second receiving member, respectively, can be achieved.

[31] The first side member may comprise two elongate flat irons arranged in parallel with each other, and the first receiving member may comprise an elongate flat iron arranged in the connection direction of the first connection member and the second connection member, and extending through an intermediate space between the two elongate flat irons of the first side member, which are arranged in parallel to each other. By means of the flat iron of the first receiving member, the movement of the parallelogram mechanism can be guided, and the lateral orientation between the first receiving member and the holder and the second receiving member, respectively, can be stabilized. Also the second side member may comprise two elongate flat irons arranged in parallel with each other, and the flat iron of the first receiving member may extend through an intermediate space between the two elongate flat irons of the second side member, which are arranged in parallel with each other.

[32] The parallelogram mechanism may be directly or indirectly hinged to the first receiving member.

[33] The second receiving member may be detachably attachable to the holder. Due to the detachable attachment, the second receiving member can be detached from the holder and, thus from the parallelogram mechanism and the first receiving member, for example, when decoupling a trailer from a towing vehicle.

[34] The second receiving member may comprise a grip portion. The grip portion facilitates detachment of the second receiving member from the holder, as the grip portion can be easily gripped by a user.

[35] The holder may comprise two bolts. The second receiving member may comprise two recesses, and may be attached to the holder by fitting the two recesses onto the two bolts.

[36] The multifunction connector may be coupled to a moving mechanism other than a parallelogram mechanism. Generally, a moving mechanism is to be understood as a device by means of which two members can be moved relatively to each other. In the multifunction connector of the present disclosure, the first receiving member and the second receiving member are moved substantially linearly along the connection direction of the first connection member and the second connection member, i.e. in the direction in which the first connection member and the second connection member are connected with each other (e.g. the direction in which two complementary plugs or hose couplings are plugged/fit together), and relatively to each other, by means of the moving mechanism, without being tilted or twisted. That is, the relative orientation and angular posture, respectively, of the two receiving members is maintained during movement. Thus, problems in connecting the connection members like, for example, canting, can be eliminated. The use of additional guide members like, for example, guiding pins is not necessarily required, as the disclosed moving mechanisms ensure stable guiding of the receiving members.

[37] In one embodiment, the moving mechanism comprises a holder for detachably attaching the second receiving member to the moving mechanism, a working cylinder, which is a hydraulic cylinder or a pneumatic cylinder or an electric cylinder, and is provided with a piston rod that is movable in the connection direction of the first connection member and the second connection member. The working cylinder may be attached to the receiving member. The moving mechanism is configured to move the holder with the attached second receiving member between the opened state and the closed state by means of displacement of the piston rod.

[38] The moving mechanism according to this embodiment may be operated by use of hydraulic fluid or pressurized air, which is provided at the towing vehicle, and ensures a stable movement of the second receiving member relatively to the first receiving member, without changing the orientation of the second receiving member relatively to the first receiving member.

[39] The moving mechanism may comprise a first sub-mechanism and a second sub-mechanism, which are displaced with respect to each other by a third distance of at least 10 cm, or at least 20 cm, or at least 30 cm in a direction perpendicular to the connection direction of the first connection member and the second connection member. Each of the first sub-mechanism and the second sub-mechanism may comprise a working cylinder, which is a hydraulic cylinder or a pneumatic cylinder or an electric cylinder and is provided with a piston rod, which is movable in the connection direction of the first connection member and the second connection member, and on which a holder for detachably attaching the second receiving member to the moving mechanism is provided. The structure with two sub-mechanisms allows for a particularly stable guiding of the movement of the two receiving members relatively to each other.

[40] Each of the first sub-mechanism and the second sub-mechanism may comprise a holder. The first sub-mechanism and the second sub-mechanism may share a common holder.

[41] The working cylinder may be a double-acting cylinder with a first connection port and a second connection port, which cylinder is configured to move the holder with the attached second receiving member to the closed state when a pressure medium is supplied to the first connection port, and to move the holder with the attached second receiving member to the opened state when a pressure medium is supplied to the second connection port. In this embodiment, the multifunction connector can be both opened and closed using the pressure medium.

[42] Alternatively, the working cylinder may be a single-acting cylinder. The piston rod of the single-acting cylinder can be pushed out of the cylinder and pulled into the cylinder, respectively, by supplying a pressure medium to the

cylinder. Movement of the piston rod in the reverse direction may be achieved by discharging the pressure medium from the cylinder, and by returning the piston rod to its initial position, for example, by means of a spring.

[43] The holder may be provided on the piston rod. In particular, the holder may be formed directly on the piston rod. The holder may be a separately formed member, which is attached to the piston rod, or the holder may be formed integrally with the piston rod. The holder may be partly formed by the piston rod. Part of the piston rod may, for example, be provided with an external thread onto which thread flange portions and nuts for securing the second receiving member are screwed.

[44] Instead of the working cylinder, the moving mechanism may be provided with a hand lever, which is attached to the second receiving member. The moving mechanism may be configured to move the holder with the attached second receiving member between the opened state and the closed state by movement of the hand lever.

[45] The moving mechanism may further comprise a shaft, which is supported on the first receiving member and rotatable about an axis, a first lever, which is fixedly attached to the shaft at its one end and hingedly connected with the piston rod at its other end, and a second lever, which is fixedly attached to the shaft at its one end and hingedly connected with the holder at its other end. The first lever, the shaft and the second lever may be configured to convert a movement of the piston rod into a substantially linear movement of the holder with the attached second receiving member along the connection direction of the first connection member and the second connection member. Specifically, the first lever, the shaft and the second lever may redirect the movement of the piston rod. Thus, the freedoms in the arrangement of the working cylinder are increased compared to a structure where the holder is provided directly at the piston rod.

[46] In a further embodiment, the moving mechanism comprises a pinion which is rotatably supported on the first receiving member, a rack which is movable in the connection direction of the first connection member and the second connection member and meshes with the pinion, and a holder for

detachably attaching the second receiving member to the moving mechanism, which holder is attached to the rack. The moving mechanism is configured to move the holder with the attached second receiving member between the closed state and the opened state by rotation of the pinion and an associated displacement of the rack.

[47] In a further embodiment, the moving mechanism comprises a holder for detachably attaching the second receiving member to the moving mechanism, and a chain, rope or belt drive. The chain, rope or belt drive comprises a first wheel, a second wheel and a chain, rope or belt which extends around the first wheel and the second wheel, and on which the holder is attached, and is configured to move the holder with the attached second receiving member between the closed state and the opened state by rotation of the first wheel and the second wheel and an associated movement of the chain, rope or belt.

[48] The moving mechanism may be provided with an application point for a detachably attachable load application device, by means of which the pinion or at least one of the first wheel and the second wheel is rotatable. The load application device may be a hand lever or another mechanical adjustment device. By means of the load application device, the moving mechanism can be operated by muscle power.

[49] Also the moving mechanisms of the embodiments comprising the rack and the chain or rope or belt, respectively, may comprise a left and a right sub-mechanism. The left and the right sub-mechanisms may have the same structure. The left and the right sub-mechanisms may be displaced from each other by the third distance. Rotary members, like pinions or gears, of the left and right sub-mechanisms may be connected via a shaft such that they are integrally rotatable.

[50] In a further embodiment, the moving mechanism comprises a holder for detachably attaching the second receiving member to the moving mechanism, and a piston rod drive provided with a sleeve that is attached to the first receiving member, a piston member that is movably guided within the sleeve, and on which the holder is provided, and a piston rod member that is hingedly connected with the piston member for sliding the piston member within the sleeve, as well as a

lever which is rotatably supported on the first receiving member at its one end, and hingedly connected with the piston rod member at its other end. The moving mechanism is configured to move the holder with the attached second receiving member between the opened state and the closed state by means of rotation of the lever and an associated displacement of the piston member by the piston rod member.

[51] Also in this embodiment, the moving mechanism may comprise a first sub-mechanism and a second sub-mechanism which are displaced with respect to each other by the third distance in a direction perpendicular to the connection direction of the first connection member and the second connection member. The moving mechanism may further comprise a shaft. Each of the first and second sub-mechanisms may comprise a piston rod drive and a lever whose end which is supported on the first receiving member is fixedly connected with the shaft, such that a rotary movement of the shaft is converted into a linear movement of the piston members by means of the levers and the piston rod members.

[52] The moving mechanism may have an application point for a detachably attachable hand lever, by means of which the lever and the shaft, respectively, can be rotated. The hand lever may be fixedly connected with the lever and the shaft, respectively.

[53] Also when using moving mechanisms other than a parallelogram mechanism, the first receiving member or the holder may be provided with a sleeve that is oriented in parallel with the connection direction of the first connection member and the second connection member, and the respective other one of the first receiving member and the holder may be provided with a bolt that is oriented in parallel with the connection direction of the first connection member and the second connection member, and extends through the sleeve.

[54] The moving mechanism may be directly or indirectly hinged or attached to the first receiving member.

[55] Further aspects relate to an assembly unit comprising a first receiving member and a parallelogram mechanism and movement mechanism, respectively, for attachment on a towing vehicle, as well as to a second receiving

member for receiving connection members of lines of a vehicle trailer, or of a system, a machine, or a device. The term “vehicle trailer” also includes, for example, agricultural devices such as a device for distribution of pesticides, or a front-end loader, or a dozing blade.

[56] According to a further aspect, a towing vehicle comprises a multifunction connector, wherein the first receiving member and the parallelogram mechanism and moving mechanism, respectively, are attached to the towing vehicle. The first receiving member receives first connection members of towing vehicle side lines.

[57] Second connection members of trailer side lines may be received by the second receiving member. Accordingly, the first receiving member and the parallelogram mechanism and moving mechanism, respectively, have to be provided only once, i.e. on the towing vehicle, while the second receiving member, which may have a comparatively simple form, e.g. may be formed by a plate, can be provided on various trailers and other attachment equipment, respectively, which are intended to be coupled to the towing vehicle. Thus, costs can be reduced.

[58] Standardized plugs can be used with the present multifunction connector. Specific plugs, in particular seals which have to be pressed together, are not required. This reduces costs and expenditures with regard to replacement parts. Individual plugs of individual lines can be connected separately with the corresponding plugs (connection members) on a receiving member. That is, for example, the first receiving member may be provided on a towing vehicle, and individual plugs of lines on a vehicle trailer can be connected with the corresponding plugs (first connection members) on the first receiving member, without requiring that the plugs of the lines on the vehicle trailer are attached to a second receiving member. The first receiving member is compatible with individual second connection members. Thus, the second receiving member is optional, and the first receiving member can be used without a second receiving member.

[59] According to a further aspect of the present disclosure, a multifunction connector comprises a first receiving member for receiving at least one first

connection member, a second receiving member for receiving at least one second connection member connectable with the first receiving member, and a moving mechanism which is configured to move the second receiving member substantially linearly along a connection direction of the first connection member and the second connection member between an opened state in which the first connection member and the second connection member are disconnected from each other, and a closed state in which the first connection member and the second connection member are connected with each other, relatively to the first receiving member. A quick coupling with a cover that can be opened by means of a hand lever, which quick coupling forms a first connection member, and a locking member are attached to the first receiving member. By means of the locking member, the hand lever can be locked in a position in which the cover is opened for connecting second connection members with the quick coupling. The second receiving member is detachably attached to the moving mechanism.

[60] The locking member may be a spring latch with a pin, which is configured to be moved along an axis extending in the longitudinal direction of the pin, between a position in which the pin blocks a movement of the hand lever, and a position in which the pin does not impair the movement of the pin, by rotation about said axis.

[61] A multifunction connector according to the present disclosure may be used in a dolly vehicle, a tractor/hauler, a trailer, a semitrailer, an accessory equipment, a machine or any towing combination with a towing vehicle/tractor and a motor driven unit, respectively, and also in self-propelled units (inter alia a self-propelled dolly/dolly axle).

#### Brief Description of the Drawings

[62] Further features and aspects of the disclosure are apparent from the following description and the attached drawings, in which:

Fig. 1 shows a perspective view of a multifunction connector according to a first embodiment in an opened state, viewed from the rear left,

Fig. 2 shows a side view of the multifunction connector according to the first embodiment in the opened state, viewed from the rear right,

Fig. 3 shows a side view of the multifunction connector according to the first embodiment in a closed state, viewed from the right,

Fig. 4 shows a plan view of a second receiving member, viewed from the rear,

Fig. 5 shows a perspective view of a multifunction connector according to a second embodiment in the opened state, viewed from an elevated position at the rear left,

Fig. 6 shows a perspective view of the multifunction connector according to the second embodiment in the closed state, viewed from an elevated position at the rear left,

Fig. 7 shows a perspective view of a multifunction connector according to a third embodiment in the opened state, viewed from an elevated position at the rear right,

Fig. 8 shows a perspective view of a multifunction connector according to a fourth embodiment in the opened state, viewed from an elevated position at the rear right,

Fig. 9 shows a side view of the multifunction connector according to the fourth embodiment in the opened state, viewed from the right,

Fig. 10 shows a side view of the multifunction connector according to the fourth embodiment in the closed state, viewed from the right,

Fig. 11 shows a perspective view of a multifunction connector according to a fifth embodiment in the opened state, viewed from an elevated position at the rear right,

Fig. 12 shows a side view of the multifunction connector according to the fifth embodiment in the opened state, viewed from the right,

Fig. 13 shows a side view of the multifunction connector according to the fifth embodiment in the closed state, viewed from the right,

Fig. 14 shows a perspective view of a multifunction connector according to a sixth embodiment in the opened state, viewed from a position at the rear right,

Fig. 15 shows a side view of the multifunction connector according to the sixth embodiment in the opened state, viewed from the right,

Fig. 16 shows a side view of the multifunction connector according to the sixth embodiment in the closed state, viewed from the right,

Fig. 17 shows a perspective, partially sectional view of the multifunction connector according to the sixth embodiment in the closed state, viewed from an elevated position at the rear left,

Fig. 18 shows a perspective, partially sectional view of a multifunction connector according to a seventh embodiment in the opened state, viewed from an elevated position at the rear left,

Fig. 19 shows a perspective, partially transparent view of a multifunction connector according to an eighth embodiment in the opened state, viewed from an elevated position at the rear left,

Fig. 20 shows a perspective, partially transparent view of the multifunction connector according to the eighth embodiment in the closed state, viewed from an elevated position at the rear left,

Fig. 21 shows a perspective view of a multifunction connector according to a ninth embodiment in the closed state, viewed from an elevated position at the rear left, and with a transparently illustrated second receiving member,

Fig. 22 shows a perspective, partially sectional view of the multifunction connector according to the ninth embodiment in the opened state, viewed from an elevated rear left position,

Fig. 23 shows a perspective view of the multifunction connector according to the ninth embodiment in the opened state, viewed from a position at the rear left above the multifunction connector,

Fig. 24 shows a perspective view of a multifunction connector according to a tenth embodiment in the closed state, viewed from an elevated position at the rear left,

Fig. 25 shows a perspective view of an assembly unit with a first receiving member and a parallelogram mechanism according to the tenth

embodiment without adapter plates, viewed from an elevated position at the rear right,

Fig. 26 shows a perspective view of the assembly unit with the first receiving member and the parallelogram mechanism according to the tenth embodiment, with adapter plates as well as hydraulic/pneumatic/pressurized air/electric/electronic and control couplings or connections, respectively, viewed from an elevated position at the rear right,

Fig. 27 shows a perspective view of a second receiving member according to the tenth embodiment without adapter plates, viewed from an elevated position at the front right,

Fig. 28 shows a perspective view of the second receiving member according to the tenth embodiment with adapter plates as well as hydraulic/pneumatic/pressurized air/electric/electronic and control couplings or connections, respectively, viewed from an elevated position at the front right, and

Fig. 29 shows a perspective view of a multifunction connector according to an eleventh embodiment in the closed state, viewed from a bottom position at the rear left.

#### Detailed description of embodiments

[63] In the description of this invention, information regarding directions refers to the directions shown in Fig. 1, which may correspond to the directions of a vehicle or vehicle trailer to which the multifunction connector is attached. For example, the direction referred to as “front” in Fig. 1 may be a driving direction of the vehicle or vehicle trailer, and the direction referred to as “rear” may be opposite to the driving direction. However, the directions shown in Fig. 1 do not necessarily have to correspond to the directions of the vehicle or vehicle trailer. For example, the direction referred to as “front” may be the direction opposed to the driving direction, and the direction referred to as “rear” may be the driving direction. The direction referred to as “front”, may also be directed to the right or to the left, and the direction referred to as “rear” may be correspondingly directed to the left or to the right. Also an inclined or tilted arrangement is possible.

[64] In the following, a first embodiment of the present disclosure will be described with reference to Figs. 1 to 4.

[65] Fig. 1 shows a multifunction connector 1 in a perspective view from an elevated position at the rear left. The state of the multifunction connector 1 shown in Fig. 1 corresponds to an opened state. The multifunction connector 1 comprises a first receiving member 2 and a second receiving member 3.

[66] The first receiving member 2 has a first plate 2a with a plurality of first holes 4, as well as a left side wall 2b and a right side wall 2c. First connection members 20 like, for example, plugs/connectors/couplings of electrical lines and/or control lines and/or hydraulic and/or pneumatic hoses 20a may be attached in the first holes 4. The first connection members 20 may be attached to the first plate 2a, for example, by welding or positive connection like screwing, or by means of locking rings.

[67] The second receiving member 3 comprises a second plate 3a with a plurality of second holes 5. Second connection members 21, which are compatible with the first connection members 20, like, for example plugs/connectors/couplings of electrical lines and/or control lines and/or hydraulic and/or pneumatic hoses 21a, may be attached in the second holes 5. The second connection members 21 may be attached to the first plate 3a, for example, by welding or positive connection like screwing, or by means of locking rings.

[68] Although only a single first connection member 20 and a single second connection member 21 are shown in Fig. 1, second connection members 20, 21, which are associated with the respective lines 20a, 21a, may be arranged in a plurality of holes, in particular in each of the first holes 4 and the second holes 5. For example, one, two, three, four, five, six, seven, eight or more first connection members 20 may be attached to the first receiving member 2. An equal, lower or larger number of second connection members 21 may be attached to the second receiving member 3.

[69] The connection members 20, 21 may be, for example, plugs and connectors/couplings, respectively, of electrical lines and power lines/cables,

respectively, of hydraulic lines/hoses (inter alia ¼ inch, ¾ inch, 1 ¼ inch ...), of pneumatic lines/hoses, of water lines/hoses, of fertilizer lines/hoses, or other types of lines/hoses. The connection members 20, 21 may be specific or standardized connection members like, for example, SVK or UDK sleeves as, for example, listed in the main catalogue 2018/2019 of Fliegl Agro-Center GmbH, Kastl. The connection members 20, 21 may be seals that can be pressed together, or standardized plugs. Standard hose couplings and standard quick couplings, respectively, like, for example, flat-sealing hydraulic sleeves / plug couplings, flat-face couplings etc., may be used. The connection members can, for example, be detachable and/or connectable under pressure. Within the second receiving member 3, flat-sealing hydraulic couplings may be integrated, in addition to subsequent mounting of SVK sleeves with regard to a trailer-side connection with SVK plugs (corresponds to a “double coupling” – a plurality of couplings arranged in succession – due to virtually non-existent leakage at the flat-sealing hydraulic couplings in connection with the commonly used SVK coupling (agricultural sector) on the trailer, accessory equipment, semitrailer – environmental & application idea). Either the first receiving member 2 or the second receiving member 3 is respectively mounted to the towing vehicle (truck, tractor, hauler etc.).

[70] When using the above double coupling, the first and/or the second connection members 20, 21 for connecting between the first and second receiving members 2, 3 are a respective flat-sealing coupling. The first and/or the second connection member 20, 21 is respectively connected with an SVK sleeve on the opposite side of the respective first or second plate 2a, 3a. A towing vehicle side and/or a vehicle side hose 20a, 21a can be provided with an SVK plug and can be connected with the SVK sleeve and, thus, with the respective first and second connection member 20, 21 via the SVK plug. Thus, the multifunction connector can be attached to, and used in, an existing towing vehicle and/or semitrailer/trailer/device, the hoses 20a, 21a of which are provided with SVK plugs, without having to modify the respective hoses 20a, 21a, by fitting the SVK plugs into the SVK sleeves. The connection between the towing vehicle side and

the trailer side hoses is then effected via the first and second connection members, which are formed as flat-sealing couplings. By means of the multifunction connector, all kinds of trailers, semitrailers, accessory equipment, machines etc. can be coupled/connected with the towing vehicle, in particular to the front and rear thereof.

[71] The connection members 20, 21 may show a tolerance regarding a coaxial orientation of the connection members 20, 21, which tolerance is required for connection and disconnection, respectively. That is, the first connection member 20 and the second connection member 21 may be connected with each other or disconnected from each other in a state in which the respective axes are tilted with respect to each other at an angle smaller than, or corresponding to, said tolerance. The tolerance may be, for example,  $1^\circ$  or  $2^\circ$  or  $3^\circ$  or  $5^\circ$ .

[72] The first plate 2a and the second plate 3a are arranged in parallel with each other and are opposed to each other at a first distance D1 (see Figs. 2 and 3). In the opened state of the multifunction connector 1 shown in Figs. 1 and 2, the first distance D1 corresponds to a first value in a range of, for example, 1 cm to 30 cm, or from 10 cm to 30 cm, preferably 5 cm to 6 cm. The first distance may, for example, be 5.4 cm.

[73] Each of the second holes 5 is arranged coaxially with regard to an opposed one of the first holes 4. The first connection members 20 and the second connection members 21 are oriented such in the opposed first holes 4 and second holes 5 that their connection direction is perpendicular to the first plate 2a and the second plate 3a. That is, the first connection members 20 and the second connection members 21 can be connected with each other by reducing the first distance D1 between the first plate 2a and the second plate 3a, without tilting or twisting the first plate 2a and the second plate 3a. In the illustration shown in the Figures, the connection direction corresponds to the front to rear direction, i.e. to a horizontal direction and a direction perpendicular to the first plate 2a and the second plate 3a, respectively.

[74] The first plate 2a has a first flat surface 2af on the side facing the second plate 3a. The second plate 3a has a second flat surface 3af on the side facing the

first plate 2a. The connection direction corresponds to a direction perpendicular to the first flat surface 2af and a direction perpendicular to the second flat surface 3af, respectively.

[75] The first receiving member 2 and the second receiving member 3 are detachably connected with each other via a parallelogram mechanism 6. In the present embodiment, the parallelogram mechanism 6 is fixedly connected with the first receiving member 2, and the second receiving member 3 is detachably attached to the parallelogram mechanism 6. The parallelogram mechanism 6 has a right (first) sub-mechanism 6a and a left (second) sub-mechanism 6b.

[76] Fig. 2 shows a side view of the multifunction connector 1 in the opened state, viewed from the right. As shown in Fig. 2, the right sub-mechanism 6a is provided with a holder 15A for attaching the second side member 3, an elongate first side member 9, and an elongate second side member 10. The first side member 9 of the present embodiment consists of two elongate flat irons 9d and 9e, which are arranged in parallel with each other, as shown in Fig. 1.

Alternatively, the first side member 9 may consist of a single flat iron or a plurality of flat irons, or similar components like, for example, rods. The second side member 10 of the present embodiment consists of two elongate flat irons 10d and 10e, which are arranged in parallel with each other, as shown in Fig. 1.

Alternatively, the second side member 10 may consist of a single flat iron or a plurality of flat irons, or similar components like, for example, rods. The first side member 9 and the second side member 10 may have the same length.

[77] The first side member 9 and the second side member 10 are substantially arranged in a plane (drawing plane in Fig. 2), which is in parallel with the connection direction of the first and second connection members 20, 21 (i.e. the front to rear direction). In other words, the first side member 9 and the second side member 10 substantially lie in a plane, which is defined by the front to rear direction and the up and down direction. Here, “substantially in a plane” means that the flat irons 9d and 10d are slightly displaced to the left with regard to the flat irons 9e and 10e. Alternatively, the first side member 9 and the second side

member 10 may be formed in parallel planes, which are in parallel with the connection direction of the first and second connection members 20, 21.

[78] The first side member 9 is arranged in parallel with the second side member 10. In other words, a longitudinal direction of the flat irons 9d and 9e is in parallel with a longitudinal direction of the flat irons 10d and 10e. The second side member 10 is displaced with regard to the first side member 9 by a fourth distance D4 in the connection direction of the connection members 20, 21. The fourth distance D4 is, for example, at least 1 cm, at least 5 cm, at least 10 cm, at least 20 cm, or at least 30 cm. The fourth distance D4 is, for example, 12 cm.

[79] At a first connection point 22a, a first (lower) end 9a of the first side member 9 is hingedly connected with the front portion of a lower, backwardly extending, portion of the right side wall 2c of the first receiving member 2, and with a first (front) end 7a of a third side member 7, by means of a pin. At a second connection point 22b, a second (upper) end 9b of the first side member 9 is hingedly connected with a front portion 8a of the holder 15A, by means of a pin.

[80] At a third connection point 22c, a first (lower) end 10a of the second side member 10 is hingedly connected with a rear portion of the lower, rearwardly extending, portion of the right side wall 2c of the first receiving member 2, and a second (rear) end 7b of the third side member 7, by means of a pin. At a fourth connection point 22d, a second (upper) end 10b of the second side member 10 is hingedly connected with a rear portion 8b of the holder 15a, by means of a pin.

[81] Due to the hinged connection by means of the pins, the first side member 9 and the second side member 10 are pivotable with regard to the first receiving member 2 and the holder 15A and the second receiving member 3 attached to the holder 15A, respectively, in the drawing plane of Fig. 2, i.e. about respective axes perpendicular to the drawing plane and the plane in which the first side member 9 and the second side member 10 are arranged, respectively. Instead of the pins, screws may be provided at the connection points 22a, 22b, 22c, 22d.

[82] In the illustration shown in Fig. 2, the connection points 22a, 22b, 22c, 22d of the side members 9, 10 and the first receiving member 2 and the holder

15A, respectively, form the corners of a parallelogram. A line between the first connection point 22a and the second connection point 22b forms a first side of the parallelogram. A line between the third connection point 22c and the fourth connection point 22d forms a second side of the parallelogram, which is in parallel with the first side. A line between the first connection point 22a and the third connection point 22c forms a third side of the parallelogram. A line between the second connection point 22b and the fourth connection point 22d forms a fourth side of the parallelogram, which is in parallel with the third side. The first side and the second side of the parallelogram have an identical length, i.e. the distance between the first connection point 22a and the second connection point 22b, and the distance between the third connection point 22c and the fourth connection point 22d are identical. The third side and the fourth side of the parallelogram have an identical length, i.e. the distance between the first connection point 22a and the third connection point 22c, and the distance between the second connection point 22b and the fourth connection point 22d are identical.

[83] An angle  $\alpha$  is formed between the first side and the third side of the parallelogram, and between the second side and the fourth side of the parallelogram. An angle between the first side and the fourth side of the parallelogram, as well as an angle between the second side and the third side of the parallelogram corresponds to  $180^\circ - \alpha$ .

[84] The right sub-mechanism 6a comprises an elongate intermediate member 11 which, in the present embodiment, is formed as a flat iron, and a rotary member 12. Alternatively, for example, a rod may be used as the intermediate member 11. The rotary member 12 is connected with the first receiving member 2 via the third side member 7, and rotatable about a first axis X, which is arranged perpendicular to the plane of the parallelogram, i.e. the drawing plane in Fig. 2. At a fifth connection point 22f, a first end 11a of the intermediate member 11, in a longitudinal direction of the intermediate member 11, is hingedly connected with a central portion 9c of the first side member 9, by means of a pin. The central portion 9c is located between the first end 9a and the second end 9b,

in the longitudinal direction of the first side member 9. At a sixth connection point 22e, a second end 11b of the intermediate member 11 is hingedly connected with an eccentric portion 12a of the rotary member 12, by means of a pin. The eccentric portion 12 is displaced with respect to the first axis X by a fifth distance d. The rotary member 12 and the intermediate member 11 form a knee lever mechanism.

[85] Due to the hinged connection of the side members 9, 10 with the first receiving member 2 and the holder 15A, the parallelogram can be sheared, i.e. the angle  $\alpha$  can be changed. The angle  $\alpha$  is variable within a first range. Shearing of the parallelogram is limited to the first range by the intermediate member 11 and the rotary member 12. The first range is, for example, a range of  $60^\circ$  to  $120^\circ$ , or  $70^\circ$  to  $110^\circ$ , or  $80^\circ$  to  $100^\circ$ .

[86] In the illustration shown in Fig. 2, which corresponds to an opened state of the multifunction connector 1, the angle  $\alpha$  is smaller than  $90^\circ$ . For example, the angle  $\alpha$  is smaller than  $85^\circ$ , or smaller than  $80^\circ$ . By rotating the rotary member 12 in clockwise direction in the illustration in Fig. 2, the eccentric portion 12a, which is arranged on the left above the first axis X in Fig. 2, i.e. the sixth connection point 22e, is rotated clockwise about the first axis X. Thereby, the intermediate member 11, which is connected with the eccentric portion 12a at its second end 11b, is pressed forward (to the right in Fig. 2) toward the first side member 9 and the first plate 2a, and the first side member 9, which is connected with the first end 11a of the intermediate member 11 at the central portion 9c, is pressed towards the first plate 2a. As the first end 9a of the side member 9 is hingedly connected with the right side wall 2c of the first receiving member 2, the first side member 9 is pivoted about the first end 9a in clockwise direction due to the force applied by the intermediate member 11, such that the angle  $\alpha$  is increased. Thereby, the parallelogram is sheared, i.e. also the second side member 10 is pivoted about the first end 10a and the third connection point 22c, respectively, in the clockwise direction. By shearing the parallelogram, the holder 15A with the attached second receiving member 3, in addition to the second plate 3a, is displaced forward (to the right in Fig. 2) toward the first plate 2a, while the

second receiving member 3 maintains its orientation with regard to the first receiving member 2. That is, the third and the fourth side of the parallelogram remain in parallel with each other during shearing.

[87] During shearing, the first distance D1 between the first plate 2a and the second plate 3a and the first flat surface 2af and the second flat surface 3af, respectively, is decreased with respect to the first value in the opened state. In other words, by shearing, the multifunction connector 1 is brought into a closed state as illustrated in Fig. 3. In the closed state, the first distance D1 corresponds to a second value which is, for example, in a range of 0 cm to 10 cm, or 1 mm to 10 cm, or 1 cm to 10 cm, and the angle  $\alpha$  is, for example, at least  $100^\circ$  and  $110^\circ$ , respectively. Preferably, the first distance D1 in the closed state is 5.4 cm. The difference between the first value in the opened state of the multifunction connector 1 and the second value in the closed state of the multifunction connector 1 may, for example, be at least 3 cm or at least 5 cm. In the present embodiment, it is not necessary required that the first flat plane 2af and the second flat plane 3af abut each other in the closed state. In the closed state, there may be a distance of at least 1 mm or at least 1 cm between the first flat surface 2af and the second flat surface 3af. Alternatively, the first flat surface 2af and the second flat surface 3af may abut each other and be pressed against each other, respectively, in the closed state, i.e. the second value may be 0 cm.

[88] As the angle  $\alpha$  in the first range is approximately  $90^\circ$ , a second distance D2 between the third side and the fourth side of the parallelogram remains substantially unchanged, or is only slightly changed, during shearing. That is, the second receiving member 3 moves substantially horizontally along a direction perpendicular to the first flat surface 2af and the second flat surface 3af, i.e. along the connection direction of the first connection members 20 and the second connection members 21, towards the first receiving member 2, while it substantially does not move, or only slightly moves, in the vertical direction. The second distance D2 is, for example, at least 10 cm, or at least 20 cm, and at most 50 cm. Preferably, the second distance D2 is 16.5 cm. The change in the second

distance D2 during shearing is, for example, at most 2 cm, or at most 5 mm, or at most 2 mm, preferably 1.5 mm.

[89] The second receiving member 3 substantially maintains its orientation with regard to the first receiving member 2 during shearing, i.e. the first flat surface 2af and the second flat surface 3af are neither tilted nor twisted with respect to each other. Due to the fact that the second receiving member 3 is attached to the holder 15A, minor tilting of the second receiving member 3 is possible. The connection directions of the first connection members 20 and the second connection members 21 substantially remain in parallel with each other. The first connection members 20 and the second connection members 21 substantially remain oriented coaxially opposed with respect to each other.

[90] As shown in Fig. 1, and analogous to the right sub-mechanism 6a, the left sub-mechanism 6b also has the above described structure comprising a holder 15B, a first side member 9, a second side member 10, a third side member 7, an intermediate member 11, and a rotary member 12.

[91] The rotary member 12 of the right sub-mechanism 6a and the rotary member 12 of the left sub-mechanism 6b are connected with each other via a shaft 14. The shaft 14 extends along the first axis X and transmits torque between the rotary member 12 of the right sub-mechanism 6a and the rotary member 12 of the left sub-mechanism 6b, such that the two rotary members 12 are rotated integrally with each other, and the parallelogram of the right sub-mechanism 6a and the parallelogram of the left sub-mechanism 6b are sheared synchronously with respect to each other. That is, the angle  $\alpha$  between the first side and the third side of the parallelogram is identical for the right sub-mechanism 6a and the left sub-mechanism at any point in time. The shaft 14 may be omitted.

[92] The rotary member 12 of the right sub-mechanism 6a and the rotary member 12 of the left sub-mechanism 6b are supported on the third side member 7 of the right sub-mechanism 6a and the third side member 7 of the left sub-mechanism 6b, via the shaft 14. As shown in Fig. 1, the third side member 7 has a loop structure 7c in a rear portion before the second end 7b, through which loop structure the shaft 14 is guided. The shaft 14 is supported by the loop structure

7c, together with a lower, rearward extended portion of the corresponding side wall 2b, 2c of the first receiving member 2.

[93] A third distance D3 between the right sub-mechanism 6a and the left sub-mechanism 6b is, for example, at least 5 cm, or at least 10 cm, or at least 20 cm, or at most 60 cm, preferably 31 cm. The length of the shaft 14 substantially corresponds to the third distance D3, or is larger than the third distance D3 by a few centimeters.

[94] As shown in Figs. 1 to 3, a hand lever 13 can be attached to the parallelogram mechanism 6. A first end 13a of the hand lever 13 is attached to a right end of the shaft 14. The shaft 14 transmits a torque applied by the hand lever 13 to the rotary member 12 of the right sub-mechanism 6a, and to the rotary member 12 of the left sub-mechanism 6b. The above described clockwise rotation of the rotary member 12 from the opened state of the multifunction connector 1, as illustrated in Fig. 2, to the closed state of the multifunction connector 1, as illustrated in Fig. 3, can be achieved by pivoting a second end 13b of the hand lever 13 clockwise along a direction H. By pivoting the second end 13b of the hand lever 13 in counter-clockwise direction, and by the associated rotation of the shaft 14 and the rotary member 12 in counter-clockwise direction, the multifunction connector 1 can be returned from the closed state, as illustrated in Fig. 3, to the opened state, as illustrated in Fig. 2. That is, a rotation of the rotary member 12 by means of the hand lever 13 causes the above described shearing of the parallelogram.

[95] The hand lever 13 is detachably or removably attached to an attachment portion (receiving portion) of the shaft 14. Specifically, the hand lever 13 may be attached to the attachment portion of the shaft 14 in different positions.

Alternatively, the hand lever 13 may be fixedly mounted to the shaft 14. A specifically formed lever or a customary wrench may be used as the hand lever 13. In the illustrated embodiment, the hand lever 13 is attached to the right end of the shaft 14. In an alternative embodiment, the hand lever 13 may be attached to the left end of the shaft 14, instead of to the right end, or a hand lever 13 may be attached both to the left end and the right end of the shaft 14.

[96] Further, optionally, a pressure relief device and, if necessary, an oil collection device, e.g. in SVK sleeves, may be integrated in the hand lever 13. By means of such a device, a residual pressure at SVK sleeves can be released, in order to enable connection of the same.

[97] Instead of the hand lever 13, and instead of the rotary member 12 and the intermediate member 11, the parallelogram mechanism 6 may comprise an alternative, for example, a different mechanical or an electric, hydraulic or pneumatic adjustment mechanism, which causes the shearing of the parallelogram.

[98] In the opened state of the multifunction connector 1, which is illustrated in Fig. 2, the sixth connection point 22e, at which the second end 11b of the intermediate member 11 is connected with the rotary member 12, is located above a virtual straight line, which connects the first axis X and the fifth connection point 22f, at which the first end 11a of the intermediate member 11 is connected with the central portion 9c of the first side member 9, with each other. In the closed state of the multifunction connector 1, which is illustrated in Fig. 3, the sixth connection point 22e is located below said virtual straight line. That is, the sixth connection point 22e crosses the virtual straight line during the transition between the opened state and the closed state. The transition state where the sixth connection point 22e is located exactly on the virtual straight line corresponds to a dead center of the knee lever mechanism formed by the rotary member 12 and the intermediate member 11, where the angle  $\alpha$  reaches its maximum value. By passing the dead center, the multifunction connector 1 is secured in the closed state, and the closed state can only be reversed by applying a torque on the rotary members 12 in the counter-clockwise direction. Thus, the closed state can be securely maintained, even in case the multifunction connector 1 is subject to vibrations.

[99] The second receiving member 3 comprises the second plate 3a. Instead of the second plate 3a, alternatively, a differently formed component may be used. Fig. 4 shows a plan view of the second plate 3a, viewed from the rear. On its upper surface, the second plate 3a is provided with a grip portion 3b in the form

of a loop, and on its right side and left side, respectively, it is provided with a recess 3c that opens downward. In addition to the grip portion 3b, a further (second) grip portion may be provided in order to facilitate/improve operation. The second plate 3a comprises a plurality of second holes 5. The second holes 5 are formed substantially circular, and have a diameter in the range of 1 cm to 8 cm, preferably a diameter of 3 cm. The second holes 5 may also have a different shape, for example, square, rectangular, or hexagonal. The second holes 5 are formed such that the second connection members 21, that is, for example, plugs of electrical lines and/or connectors/couplings of hydraulic and/or pneumatic hoses, can be attached in the second holes 5. Specifically, customary plugs and connectors/couplings, respectively, can be used for this purpose. It is not required to use specific custom-made plugs and connectors/couplings, respectively.

[100] As illustrated in Fig. 1, the first plate 2a comprises a plurality of first holes 4. The first holes 4 are formed substantially circular and have a diameter in the range of 1 cm to 8 cm. The first holes 4 may also have a different shape, for example, square, rectangular, or hexagonal. The first holes 4 are coaxially opposed to the second holes 5, i.e., one of the first holes (first opening) 4 is coaxially opposed to one of the second holes (second opening) 5, respectively. The first holes 4 are formed such that the first connection members 20, i.e., for example, plugs of electrical lines and/or connectors/couplings of hydraulic and/or pneumatic hoses, can be attached in the first holes 4. Specifically, customary plugs and connectors/couplings, respectively, can be used for this purpose. It is not required to use specific custom-made plugs and connectors/couplings, respectively. The first connection members 20 arranged in the first holes 4 are complementary counterparts of the respective second connection members 21, which are arranged in the opposed second holes 5.

[101] When the multifunction connector 1 is brought from the opened state to the closed state, the connection members 20, 21 attached in the first holes 4 and second holes 5 are connected with each other. When the multifunction connector 1 is brought from the closed state to the opened state, the connection members 20, 21 are disconnected from each other. Due to the fact that the first plate 2a and

the second plate 3a are arranged in parallel with each other, and due to the fact that this parallel orientation is substantially maintained during opening and closing of the multifunction connector 1, problems in connecting and disconnecting the connection members 20, 21 like, for example, canting, are eliminated. This allows for simple, quick and secure connection of the electric lines and hydraulic or pneumatic hoses 20a, 21a, respectively. Here, the term “hydraulic hoses” inter alia includes water hoses and fertilizer hoses.

[102] The second plate 3a is detachably attached to the right sub-mechanism 6a and the left sub-mechanism 6b, respectively, by means of the holder 15A and the holder 15B. Each of the two holders 15A, 15B is provided with a bolt 15a having an external thread, on which bolt two nuts 15m and two flange portions 15b are provided. The nuts 15m and the flange portions 15b respectively have an internal thread. Due to the external thread of the bolt 15a and the internal threads of the nuts 15m and the flange portions 15b, the positions of the nuts 15m and the flange portions 15b on the bolt 15a are adjustable by rotating the nuts 15m and the flange portions 15b, respectively. Each of the nuts 15m is fixed and tightened, respectively, to a respective one of the flange portions 15b, such that the position of the flange portion 15b on the bolt 15a is fixedly adjusted. The two flange portions 15b are arranged on the bolt 15a at a distance corresponding to the thickness of the second plate 3a. The second receiving member 3 with the second plate 3a is attached to the parallelogram mechanism 6 by fitting, or attaching, the two recesses 3c of the second plate 3a on the bolts 15a of the holders 15A, 15B from above, respectively between the flange portions 15b. Conversely, the second receiving member 3 can be detached from the parallelogram mechanism 6 by lifting the second receiving member 3 from the bolts 15a, for example, by means of the grip portion 3b.

[103] Optionally, the second end 13b of the hand lever 13 can be formed as an open-end wrench, with a wrench size matching the size of the nuts 15m. Thus, the hand lever 13 can be used for adjusting, in particular re-adjusting, the nuts 15m, in the state where it is detached from the attachment portion of the shaft 14.

[104] As described above, the positions of the flange portions 15b in the longitudinal direction of the bolts 15a, i.e. in the front to rear direction, can be adjusted and adapted, respectively, by rotating the flange portions 15b, which are screwed onto the external thread of the bolts 15a with their internal threads. The second plate 3a may be clamped between the flange portions 15b by tightening the flange portions 15b after attaching/fitting the second plate 3a, for example, by means of the second end 13b of the hand lever 13, which second end is formed as an open-end wrench. Clamping of the second plate 3a by means of the flange portions 15b is, however, not necessarily required. If the distance between the flange portions 15b is adjusted such that it substantially corresponds to the thickness of the second plate 3a, the second plate can be attached to the bolts 15a with a slight clearance between the flange portions 15b. In this case, the positions of the flange portions 15b in the longitudinal direction of the bolts 15a may be adjustable only for readjustment. Alternatively, the positions of the flange portions 15b in the longitudinal direction of the bolts 15a may be fixed. In this case, the external threads of the bolts 15a, the internal threads of the flange portions 15b, and the nuts 15m are not required.

[105] The first receiving member 2 and the parallelogram mechanism 6 form an assembly unit. The first receiving member 2 and the parallelogram mechanism 6 may be, for example, fixedly attached to a towing vehicle or a trailer.

Accordingly, electrical lines or hydraulic and pneumatic hoses 20a, respectively, of the towing vehicle or the trailer to which the first receiving member 2 and the parallelogram mechanism 6 are attached, can be fixedly connected with the first receiving member 2. On the other hand, electrical lines or hydraulic or pneumatic hoses 21a of the towing vehicle or trailer, to which the first receiving member 2 and the parallelogram mechanism 6 are not attached, can be fixedly connected with the second receiving member 3. When decoupling the towing vehicle from the trailer, the multifunction connector 1 is brought to the opened state, in which the towing vehicle side cables and the trailer side cables and hoses 20a, 21a are disconnected from each other at the respective connection members 20, 21. In the opened state of the multifunction connector 1, the second receiving member is

detached from the parallelogram mechanism 6 and the holders 15A, 15B, respectively, and can, for example, be attached to a corresponding storage holder on the towing vehicle or the trailer, where the first receiving member 2 and the parallelogram mechanism 6 are not attached. Similar to the holders 15A, 15B, the storage holder may comprise two bolts 15a and flange portions 15b, and the recesses 3c of the second receiving member 3 may be fitted on the bolts 15a of the storage holder. When coupling the towing vehicle and the trailer, the second receiving member can be taken from the storage holder on the towing vehicle or the trailer to which the first receiving member 2 and the parallelogram mechanism 6 are not attached, and can be connected with the parallelogram mechanism 6 and the holders 15A, 15B, respectively, in the opened state of the multifunction connector 1, in the above-described manner. Subsequently, the multifunction connector 1 is brought into the closed state, such that the towing vehicle side and the trailer side cables and hoses 20a, 21a are connected with each other via the connection members 20, 21.

[106] In the following, a second embodiment of the present disclosure will be described with reference to Figures 5 and 6. A multifunction connector 1A of the second embodiment substantially corresponds to the multifunction connector 1 of the first embodiment.

[107] In the multifunction connector 1A of the second embodiment, a first receiving member 2A, which substantially corresponds the first receiving member 2 of the first embodiment, is provided with a respective tubular sleeve 2d, which is oriented in the front to rear direction, on both sides in the left to right direction on the left side wall 2b and the right side wall 2c at the height of the holders 15A, 15B, as shown in Fig. 5. In the second embodiment, the bolts 15a of the holders 15A, 15B protrude towards the receiving member 2A. A front end 15c of each of the bolts 15a on the side of the first receiving member 2A is inserted into the corresponding sleeve 2d, and guided by the sleeve 2d. A bushing for receiving the front end 15c of the bolt 15a may be integrated in the sleeve 2d.

[108] The length of the bolts 15a is chosen such that the front ends protrude into the corresponding sleeves 2d, also in the opened state of the multifunction

connector 1A, as shown in Fig. 5. The front ends 15c of the bolts protrude, for example, at least 5 cm or 10 cm or 20 cm forward from the second plate 3a and toward the first plate 2a.

[109] The length of the bolts 15a can be chosen such that their front ends 15c do not protrude forward from the sleeves 2d in the opened state of the multifunction connector 1A, shown in Fig. 5. In the closed state of the multifunction connector 1A, shown in Fig. 6, the front ends 15c of the bolts 15a protrude forward from the sleeves 2d.

[110] In the region of their front ends 15c, which are inserted into the sleeves 2d, the bolts 15a do not have an external thread. The front ends 15c of the bolts 15a are inserted into the corresponding sleeves 2d with a clearance, i.e. an outer diameter of the bolts 15a at the front ends 15c is smaller than an inner diameter of the sleeves 2d. The outer diameter of the bolts 15a at their front ends 15c is, for example, by 0.1 mm to 2 mm, preferably 0.5 mm, smaller than the inner diameter of the sleeves 2d. The outer diameter of the bolts 15a at their front ends 15c is, for example, in the range of 10 mm to 30 mm. Preferably, the outer diameter of the bolts 15a at their front ends 15c is 22 mm. The inner diameter of the sleeves 2d is, for example, in the range of 12 mm to 38 mm. Preferably, the inner diameter of the sleeves 2d is 22.5 mm.

[111] By means of the front ends 15c of the bolts 15a, which front ends extend through the sleeves 2d, the movement of the holders 15A, 15B and, thus, of the second receiving member 3, is guided during shearing of the parallelogram mechanism 6, i.e. during the transition between the opened state and the closed state of the multifunction connector 1A. Due to the guiding, the position of the second receiving member 3, for example, in the left to right direction, is stabilized.

[112] In the present embodiment, the bolts 15a, onto which the second receiving member 3 is fitted and attached, respectively, are identical with the bolts 15a, which extend through the sleeves 2d for guiding the movement of the second receiving member 3. However, also separate bolts may be provided for fitting or

attaching the second receiving member 3 and for guiding the movement of the second receiving member 3.

[113] In the following, a third embodiment of the present disclosure will be described with regard to Figure 7. A multifunction connector 1B of the third embodiment substantially corresponds to the multifunction connector 1 of the first embodiment.

[114] In the multifunction connector 1B of the third embodiment, a first receiving member 2B, which substantially corresponds to the first receiving member 2 of the first embodiment, is provided on both sides in the left to right direction on the left side wall 2b and the right side wall 2c at a height between the first connection point 22a and the second connection point 22b and between the third connection point 22c and the fourth connection point 22d, respectively, in the up and down direction, with a respective elongate flat iron 2s, which protrudes rearward from the left side wall 2b and the right side wall 2c, respectively, as shown in Fig. 7. In the present embodiment, the flat irons 2s are provided at a height between the fifth connection point 22f and the second connection point 22b in the up to down direction.

[115] The flat irons 2s respectively protrude into a clearance between the two parallel arranged flat irons 9d and 9e of the first side member 9, and into a clearance between the two parallel arranged flat irons 10d and 10e of the second side member 10. The lateral surfaces of the flat irons 2s in the right to left direction may abut on the respectively opposed lateral surfaces of the flat irons 9d and 9e and the flat irons 10d and 10e, respectively.

[116] The length of the flat irons 2s is chosen such that the rear ends of the flat irons 2s are located in the space between the two flat irons 10d and 10e of the second side member 10, also in the opened state of the multifunction connector 1B, as shown in Fig. 7. The flat irons 2s may, however, also be formed shorter. For example, the length of the flat irons 2s may be chosen such that the flat irons 2s merely protrude into the space between the two flat irons 9d and 9e of the first side member 9, but do not protrude into the space between the two flat irons 10d and 10e of the second side member 10. The length of the flat irons 2s is, for

example, at least 10 cm or at least 20 cm. Preferably, the length of the flat irons 2s is 18.5 cm.

[117] The flat irons 2s have, for example, a thickness in the range of 3 mm to 10 mm. Preferably, the thickness of the flat irons 2s is 8 mm. A height of the flat irons 2s in the up and down direction may be in the range of 1 cm to 5 cm. Preferably, the height of the flat irons 2s is 3 cm. The flat irons 2s may have a substantially rectangular shape, for example with rounded corners, as shown in Fig. 7. The flat irons 2s may be formed integrally with the left and right side walls 2b, 2c, respectively, or may be attached to the same, for example, by welding.

[118] By means of the flat irons 2s extending through the spaces between the flat irons 9d and 9e, and 10d and 10e, respectively, the movement of the parallelogram mechanism 6 and, thus, of the second receiving member 3 is guided during shearing of the parallelogram mechanism 6, i.e. during the transition between the opened state and the closed state of the multifunction connector 1B. Due to the guiding, the position of the second receiving member 3 in the left to right direction is stabilized.

[119] Additionally or alternatively, stabilization of the parallelogram mechanism 6 may be effected by portions 2g of the left and right side walls 2b, 2c, which portions are provided in the first to third embodiments, and are enlarged in the up and down direction as, for example, shown in Fig. 7. The surfaces of the flat irons 9d and 9e of the first side member 9, which surfaces are directed inwards toward the intermediate spaces, may abut on the opposed surfaces of the enlarged portions 2g. In the region of the enlarged portions 2g, which extend through the respective intermediate spaces between the flat irons 9d and 9e of the first side members 9, the side walls 2b, 2c may have a height of at least 3 cm. Preferably, the height of the side walls 2b, 2c is 3.5 cm.

[120] In the following, a fourth embodiment of the present invention will be described with reference to Figures 8 to 10. A multifunction connector 1C of the fourth embodiment substantially corresponds to the multifunction connectors 1,

1A, 1B of the first to third embodiments, apart from the parallelogram mechanism 6.

[121] The first receiving member 2 and the second receiving member 3 are detachably connected with each other via a moving mechanism 106. In the present embodiment, the moving mechanism 106 is fixedly connected with the first receiving member 2, and the second receiving member 3 is detachably attached to the moving mechanism 106. The moving mechanism 106 comprises a right (first) sub-mechanism 106a and a left (second) sub-mechanism 106b.

[122] As shown in Fig. 9, the right sub-mechanism 106a comprises the holder 15A for attaching the second receiving member 3, and a working cylinder 101. The working cylinder 101 is a hydraulic cylinder with a movable piston rod 102. Alternatively, the working cylinder 101 may be a pneumatic cylinder or an electric cylinder.

[123] The working cylinder 101 is attached to the first receiving member 2 and is oriented such that its longitudinal direction is substantially in parallel with the connection direction of the first connection members 20 and the second connection members 21. The longitudinal direction of the piston rod 102 is substantially in parallel with the connection direction of the first connection members 20 and the second connection members 21. The piston rod 102 is movable in the connection direction of the first connection members 20 and the second connection members 21. The working cylinder 101 has a first connection port 103 and a second connection port 104 for supply of hydraulic fluid. The hydraulic fluid is supplied under pressure.

[124] On supply of the hydraulic fluid by means of the first connection port 103, the piston rod 102 is pulled into the working cylinder 101, i.e. the holder 15A with the attached second receiving member 3, in addition to the second plate 3a, is displaced forward (to the right in Fig. 9) toward the first plate 2a, while the second receiving member 3 maintains its orientation with respect to the first receiving member 2.

[125] During displacement, the first distance D1 between the first plate 2a and the second plate 3a, and between the first flat surface 2af and the second flat

surface 3af, respectively, is decreased with regard to the first value in the opened state. In other words, the multifunction connector 1C is brought into a closed state, as shown in Fig. 10, by the displacement. In the closed state, the first distance D1 corresponds to a second value, which may be in the range of, for example, 0 cm to 10 cm or from 1 mm to 10 cm or from 1 cm to 10 cm. Preferably, the first distance D1 in the closed state is 5.4 cm. The difference between the first value in the opened state of the multifunction connector 1C, and the second value in the closed state of the multifunction connector 1C may be, for example, at least 3 cm or at least 5 cm. In the present embodiment, it is not required that the first flat surface 2af and the second flat surface 3af abut each other in the closed state. In the closed state, a space/gap of at least 1 mm or at least 1 cm may exist between the first flat surface 2af and the second flat surface 3af. Alternatively, the first flat surface 2af and the second flat surface 3af may abut each other and be pressed against each other, respectively, in the closed state, i.e. the second value may be 0 cm.

[126] The second receiving member 3 moves substantially horizontally along a direction perpendicular to the first flat surface 2af and the second flat surface 3af, i.e. along the connection direction of the first connection members 20 and the second connection members 21, toward the first receiving member 2, and substantially does not move, or moves only slightly, in the direction perpendicular to the connection direction. The movement in the vertical direction is, for example, at most 5 mm, or at most 2 mm.

[127] During displacement, the second receiving member 3 substantially maintains its orientation with regard to the first receiving member 2, i.e. the first plane/flat surface 2af and the second flat surface 3af are neither tilted nor twisted with respect to each other. Due to the fact that the second receiving member 3 is attached to the holder 15A, slight tilting of the second receiving member 3 is possible. The connection directions of the first connection members 20 and the second connection members 21 substantially remain parallel in with each other. The first connection members 20 and the second connection members 21 substantially maintain their coaxially opposed orientation.

[128] On supply of the hydraulic fluid via the first connection port 104, the piston rod 102 is pushed out of the working cylinder 101, i.e. the holder 15A with the attached second receiving member 3, in addition to the second plate 3a, is moved to the rear (left in Fig. 10), and away from the first plate 2a, while the second receiving member 3 substantially maintains its orientation with respect to the first receiving member 2.

[129] During the displacement, the first distance D1 between the first plate 2a and the second plate 3a, and between the first flat surface 2af and the second flat surface 3af, respectively, is increased from the second value in the closed state to the first value in the opened state. In other words, by means of the displacement, the multifunction connector 1C is brought into the opened state illustrated in Fig. 9.

[130] Analogous to the right sub-mechanism 106a, the left sub-mechanism 106b is also provided with the above described structure comprising a holder 15B and a working cylinder 101. The right sub-mechanism 106a and the left sub-mechanism 106b are operated synchronously.

[131] A third distance D3 between the right sub-mechanism 106a and the left sub-mechanism 106b is, for example, at least 5 cm or at least 10 cm or at least 20 cm, and at most 60 cm, preferably 31 cm.

[132] The second plate 3a is detachably attached to the right sub-mechanism 106a and the left sub-mechanism 106b, respectively, by means of the holder 15A and the holder 15B. Each of the two holders 15A, 15B comprises the bolt 15a, which has an external thread, and on which the two nuts 15m and the two flange portions 15b are provided. In the present embodiment, the bolt 15a corresponds to the piston rod 102. The external thread is formed on the rear portion of the piston rod 102. That is, the holders 15A and 15B, respectively, are provided on a rear region of the piston rod 102.

[133] The first receiving member 2 and the moving mechanism 106 form an assembly unit. The first receiving member 2 and the moving mechanism 106 may, for example, be fixedly attached to a towing vehicle or a trailer.

[134] In the following, a fifth embodiment of the present disclosure will be described with reference to Figures 11 to 13. A multifunction connector 1D of the fifth embodiment substantially corresponds to the multifunction connector 1C of the fourth embodiment, apart from the structure of the moving mechanism 106.

[135] The multifunction connector 1D of the fifth embodiment comprises a moving mechanism 206 instead of the moving mechanism 106 of the fourth embodiment. The right side wall 2c and the left side wall 2b of the first receiving member 2 are respectively provided, at their lower regions, with a rearward extended portion 2e. The rearward extended portion 2e is substantially trapezoidal in a side view, as shown in Figures 12 and 13. An upper leg of the trapezoid extends substantially in parallel with the connection direction of the first connection members 20 and the second connection members 21. The lower leg of the trapezoid extends diagonally upward from a lower end of the first receiving member 2 toward the rear end 2f of the rearward extended portion 2e.

[136] At the rear end 2f of the rearward extended portion 2e, a shaft 214 is supported rotatable about an axis X perpendicular to the connection direction of the first connection members 20 and the second connection members 21. The shaft 214 extends between the rear ends 2f of the rearward extended portions 2e of the left side wall 2b and the right side wall 2c. The length of the shaft 214 substantially corresponds to the third distance D3 or is larger than the third distance D3 by a few centimeters.

[137] A first lever (pivot/swivel lever) 211 and two second levers (pivot/swivel levers 212) are fixedly attached to the shaft 214. The first lever 211 is arranged substantially centrally in the longitudinal direction of the shaft 214, and protrudes downward in the illustration shown in Figures 11 to 13. The two second levers 212 are respectively arranged on the right side and the left side in the longitudinal direction of the shaft 214, and protrude upward in the illustration shown in Figures 11 to 13.

[138] The moving mechanism 206 further comprises a working cylinder 201. The working cylinder 201 is a pneumatic cylinder, which is operated by supply of pressurized air. Alternatively, the working cylinder 201 may be a hydraulic

cylinder or an electric cylinder. The working cylinder 201 is attached to the first receiving member 2. The working cylinder 201 is arranged on a lower end of the first receiving member 2, on the side of the first receiving member 2, which faces away from the second receiving member 3. The working cylinder 201 may be arranged centrally in the left to right direction.

[139] The working cylinder 201 comprises a piston rod 202, which extends through the first receiving member 2, substantially in the front to rear direction. By supplying pressurized air to the working cylinder 201, the piston rod 202 is movable in the front to rear direction.

[140] A rear end of the piston rod 202 is hingedly connected with an end of the first lever 211, which end is opposed to the shaft 214. By means of a rearward movement of the piston rod 202, the shaft 214 is rotated in clockwise direction in the illustration shown in Figures 12 and 13. By means of a forward movement of the piston rod 202, the shaft 214 is rotated in counter-clockwise direction in the illustration shown in Figures 12 and 13.

[141] Analogous to the moving mechanism 106, the moving mechanism 206 comprises the two holders 15A, 15B with the bolts 15a, the flange portions 15b and the nuts 15m. The ends of the two second levers 212, which ends are opposed to the shaft 214, are hingedly connected with the bolts 15a of the first holder 15A and the second holder 15B, respectively.

[142] On both sides in the left to right direction, on the left side wall 2b and the right side wall 2c in an upper portion at the height of the holders 15a, 15B, the first receiving member 2 comprises respectively one tubular sleeve 2d oriented in the front to rear direction. A front end 15c of each of the bolts 15a is inserted into the corresponding sleeve 2d and is guided by the sleeve 2d.

[143] The length of the bolts 15a is chosen such that the front ends 15c protrude into the sleeves 2d, also in the opened state of the multifunction connector 1D, as shown in Fig. 12. The front ends 15c of the bolts protrude, for example, at least 5 cm or 10 cm or 20 cm forward from the second plate 3a and toward the first plate 2a.

[144] The length of the bolts 15a may be chosen such that the front ends 15c do not protrude forward from the sleeves 2d in the opened state of the multifunction connector 1D, as shown in Fig. 12. In the closed state of the multifunction connector 1D, as shown in Fig. 13, the front ends 15c of the bolts 15a protrude forward from the sleeves 2d.

[145] In the region of the front ends 15c, which are inserted into the sleeves 2d, the bolts 15a are not provided with an external thread. The front ends 15c of the bolts 15a are inserted into the sleeves 2d with a clearance, i.e. an outer diameter of the bolts 15a at the front ends 15c is smaller than an inner diameter of the sleeves 2d. The outer diameter of the bolts 15a at the front ends 15c is, for example, by 0.1 mm to 2 mm, preferably 0.5 mm, smaller than the inner diameter of the sleeves 2d. The outer diameter of the bolts 15a at the front ends 15c is, for example, in the range of 10 mm to 30 mm. Preferably, the outer diameter of the bolts 15a at the front ends 15c is 22 mm. The inner diameter of the sleeves 2d is, for example, in the range of 12 mm to 38 mm. Preferably, the inner diameter of the sleeves 2d is 22.5 mm.

[146] The working cylinder 201 may be a single-acting cylinder in which, for example, the piston rod 202 is pushed out of the working cylinder 201 in a rear direction, by supplying pressurized air to the working cylinder 201 via a connection port 203. When the pressurized air is discharged from the working cylinder 201, the piston rod 202 is retracted to its initial position by the force of, for example, a spring arranged in the working cylinder 201.

[147] The movement of the piston rods 202 is redirected by the shaft 214, the first lever 211, and the second levers 212. If the working cylinder 201 is operated by the pressurized air such that the piston rod 202 is pushed out of the working cylinder 201 in the rear direction, the shaft 214 rotates clockwise in the illustration in Fig. 12. Thereby, the bolts 15a, together with the holders 15A, 15B and the attached second receiving member 3, are moved forward toward the first receiving member 2, and into the closed state shown in Fig. 13. Thus, the first distance D1 is decreased from the first value to the second value. The displacement is effected horizontally, in parallel with the connection direction of

the first connection members 20 and the second connection members 21. The orientation of the second receiving member 3 with regard to the first receiving member 2 is maintained during the displacement.

[148] If the working cylinder 201 is, for example, by means of a spring force, operated such during discharge of the pressurized air that the piston rod 202 is pulled forward and into the working cylinder 201, the shaft 214 rotates in counter-clockwise direction in the illustration shown in Fig. 13. Thus, the bolts 15a, together with the holders 15A, 15B and the attached second receiving member 3 are displaced rearward and away from the first receiving member 2, in the opened state illustrated in Fig. 12. Thereby, the first distance D1 is increased from the second value to the first value.

[149] Alternatively, the working cylinder 201 may be a double-acting cylinder, where the piston rod 202 is pushed out of the working cylinder 201 on supply of pressurized air, and is also pulled into the working cylinder 201 on supply of pressurized air.

[150] Instead of operation by means of the working cylinder, manual operation, for example, by using a hand lever, is also possible.

[151] By means of the front ends 15c of the bolts 15a extending through the sleeves 2d, the movement of the holders 15A, 15B and, thus, of the second receiving member 3 is guided during the transition between the opened state and the closed state of the multifunction connector 1D. By means of this guiding, the position of the second receiving member 3, for example, in the left to right direction and in the up and down direction is stabilized.

[152] In the present embodiment, the bolts 15a, to which the second receiving member 3 is fitted and attached, respectively, are identical with the bolts 15a, which extend through the sleeves 2d for guiding the movement of the second receiving member 3. It is, however, also conceivable that separate bolts are provided for fitting or attaching the second receiving member 3, and for guiding the movement of the second receiving member 3.

[153] In the following, a sixth embodiment of the present disclosure will be described with reference to Figures 14 to 17. A multifunction connector 1E of the

sixth embodiment substantially corresponds to the multifunction connectors 1C, 1D of the fourth and fifth embodiments, apart from the structure of the moving mechanisms 106, 206.

[154] The multifunction connector 1E of the sixth embodiment comprises a moving mechanism 306 instead of the moving mechanisms 106, 206 of the first and second embodiments.

[155] Just like in the multifunction connector 1D of the fifth embodiment, the right side wall 2c and the left side wall 2b of the first receiving member 2 have the rearward extended portion 2e in the lower region thereof. At the rear end 2f of the rearward extended portions 2e of the two side walls 2b, 2c, a shaft 314 is supported rotatably about an axis X, which is perpendicular to the connection direction of the first connection members 20 and the second connection members 21. The shaft 314 extends between the rear ends 2f of the rearward extended portions 2e of the left side wall 2b and the right side wall 2c. The length of the shaft 314 substantially corresponds to the third distance D3, or is larger than the third distance D3 by a few centimeters.

[156] As shown in Fig. 17 for the left end, one gear 301 respectively is attached to both ends of the shaft 314. The gear 301 meshes with a rack 302. The rack 302 is arranged above the gear 301 and extends in the connection direction of the first connection members 20 and the second connection members 21. The rack 302 is provided with teeth at its lower side, which teeth mesh with the gear 301. The rack 302 is guided by a sleeve 303 that is attached to the rear end 2f of the rearward extended portion 2e. The sleeve 303 is opened downwards, such that the teeth of the gear 301 and the teeth of the rack 302 can mesh. The rack 302 is movable in the front to rear direction.

[157] Just like the moving mechanisms 106 and 206, the moving mechanism 306 comprises the holders 15A, 15B with the bolts 15a, the flange portions 15b and the nuts 15m. The racks 302 are fixedly connected with the bolts 15a of the holders 15A, 15B. Alternatively, the racks 302 may be formed integrally with the bolts 15a. By rotation of the shaft 314 and the gears 301, the racks 302 with the holders 15A, 15B are moved in the front to rear direction. By clockwise rotation

of the shaft 314, as illustrated in Fig. 15, the racks 302 are moved forward, such that the holders 15A, 15B, together with the attached second receiving member 3, are moved toward the first receiving member 2. Thereby, the first distance D1 is decreased from the first value in Fig. 15 to the second value in Fig. 16, and the multifunction connector 1E is brought into the closed state. By counter-clockwise rotation of the shaft 314 and the gears 301, the multifunction connector 1E is again brought into the opened state.

[158] In Figures 14 to 17, the hand lever 13 is illustrated. A first end 13a of the hand lever 13 is attached to a right end of the shaft 314. The shaft 314 transmits a torque, which is applied by the hand lever 13, to the gears 301. The above described rotation of the gears 301 for displacing the racks 302 may be effected by pivoting a second end 13b of the hand lever 13 along a direction H. By pivoting the second end 13b of the hand lever 13 in clockwise direction, the multifunction connector 1E is brought from the opened state illustrated in Fig. 15, to the closed state illustrated in Fig. 16. By pivoting the second end 13b of the hand lever 13 in counter-clockwise direction, the multifunction connector 1E is returned from the closed state to the opened state. That is, rotation of the gears 301 by means of the hand lever 13 causes the displacement of the racks 302, the holders 15A, 15B and the attached second receiving member 3.

[159] The hand lever 13 is detachably or removably attached to an attachment point 314a on the shaft 314. In particular, the first end 13a of the hand lever 13 can be attached to the attachment point 314a of the shaft 314 in different positions. Alternatively, the hand lever 13 may be fixedly mounted and connected, respectively, to the shaft 314. In the illustrated embodiment, the hand lever 13 is attached to the right end of the shaft 314. In an alternative embodiment, the hand lever 13 may be attached to the left end of the shaft 314, instead of being attached to the right end, or one hand lever 13, respectively, may be attached to both the left end and the right end of the shaft 314.

[160] In the following, a seventh embodiment of the present disclosure is described with reference to Fig. 18. A multifunction connector 1F of the seventh embodiment substantially corresponds to the multifunction connectors 1C, 1D,

1E of the fourth, fifth, and sixth embodiments, apart from the structure of the moving mechanisms 106, 206, 306.

[161] The multifunction connector 1F according to the seventh embodiment comprises a moving mechanism 406 instead of the moving mechanisms 106, 206, 306 of the first, second and third embodiments. The moving mechanism 406 is similar to the moving mechanism 306. The moving mechanism 406 comprises a shaft 414 and two second gears 408, which substantially correspond to the shaft 314 and the gears 301 of the third embodiment. The hand lever 13 can be attached to the shaft 414. The shaft 414 and the entire moving mechanism 406, respectively, may be electrically and/or pneumatically and/or hydraulically and/or electronically operable.

[162] Additionally, the moving mechanism 406 comprises two first gears 407, each of which is respectively arranged in horizontal direction in front of one of the two second gears 408. The first gears 407 and the second gears 408 are arranged at the same height. The axes of rotation of the first gears 407 and the second gears 408 are in parallel with each other. The first gears 407 are rotatably supported at the rearward extended portions 2e of the left side wall 2b and the right side wall 2c. The distance between the first gears 407 and the second gears 408 in the front to rear direction is within the range of 5 cm to 50 cm.

[163] Instead of the racks 302, the moving mechanism 406 comprises two push rods 402 and two closed chains 409. The push rods 402 are guided by sleeves 403 and are movable in the front to rear direction. The push rods 402 are respectively attached to one of the two chains 409. The corresponding chain 409 extends around the first gear 407 and the second gear 408 in a left sub-mechanism 406b and a right sub-mechanism 406a, respectively, of the moving mechanism 406.

[164] Analogous to the moving mechanisms 106, 206 and 306, the moving mechanism 406 comprises the holders 15A, 15B with the bolts 15a, the flange portions 15b and the nuts 15m. The push rods 402 are fixedly connected with the bolts 15a of the holders 15A, 15B. Alternatively, the push rods 402 may be formed integrally with the bolts 15a. On rotation of the shaft 414 and the second gears 408, the chains 409 run around the first and second gears 407, 408, and the

push rods 402 with the holders 15A, 15B are displaced in the front to rear direction. Due to the movement of the chains 409, the first gears 407 rotate substantially synchronously with the second gears 408. By rotation of the shaft 414 and the gears 407, 408 in counter-clockwise direction, as illustrated in Fig. 18, the push rods 402 are moved in the front direction, such that the holders 15A, 15B, together with the attached second receiving member 3, are moved toward the first receiving member 2. Thereby, the multifunction connector 1F is brought from the opened state, shown in Fig. 18, into the closed state. On movement of the shaft 414 and the gears 407, 408 in clockwise direction, the multifunction connector 1F is again brought into the opened state.

[165] In an alternative embodiment, ropes or belts may be used instead of the chains 409, and instead of the first and second gears 407, 408, winding rolls or wheels for guiding and moving the ropes or belts or wheels for guiding and moving the belts may be used.

[166] In the following, an eight embodiment of the present disclosure will be described with reference to Figures 19 and 20. A multifunction connector 1G of the eight embodiment substantially corresponds to the multifunction connectors 1C, 1D, 1E, 1F of the fourth, fifth, sixth and seventh embodiments, apart from the structure of the moving mechanisms 106, 206, 306, 406.

[167] The multifunction connector 1G of the eight embodiment comprises a moving mechanism 506, instead of the moving mechanisms 106, 206, 306, 406 of the fourth, fifth, sixth and seventh embodiments. The moving mechanism 506 is similar to the moving mechanisms 206 and 406. The moving mechanism 506 comprises a shaft 514. The shaft 514 is supported at rear ends 2f of the rearward extended portions 2e of the right side wall 2c and the left side wall 2b, and rotatable about an axis X, which is perpendicular to the connection direction of the first connection members 20 and the second connection members 21. The shaft 514 extends between the rear ends 2f of the rearward extended portions 2e of the left side wall 2b and the right side wall 2c. The length of the shaft 514 substantially corresponds to the third distance D3, or is larger than the third distance D3 by a few centimeters.

[168] Two levers (pivot/swivel levers) 512 are fixedly attached to the shaft 514. One end respectively of the two levers 512 is attached to the shaft 514. The two levers 512 are respectively arranged on the right side and on the left side in the longitudinal direction of the shaft 514, and protrude upward in the illustration shown in Figures 19 and 20.

[169] The moving mechanism 506 further comprises two tubular sleeves 503, which are attached on top of the rear ends 2f of the rearward extended portions 2e. In the embodiment, the tubular sleeves 503 are open in a downward direction. One piston member 502 respectively is movably guided in each of the two sleeves 503 in the connection direction of the first connection members 20 and the second connection members 21. The outer diameter of the piston member 502 is smaller than the inner diameter of the sleeve 503 and may be, for example, by 0.1 to 2 mm smaller than the inner diameter of the sleeve 503. A rear end of the piston member 502 is hingedly connected with an end of an elongate piston rod member 513. The other end of the piston rod member 513 is hingedly connected with the end of one of the second levers 512, which end is not attached to the shaft 514. The shaft 514 is provided with an attachment point 514a for the hand lever 13.

[170] At the front ends of the piston members 502, the bolts 15a of the two holders 15A, 15B are fixedly attached. Alternatively, the piston members 502 may be formed integrally with the bolts 15a. Front ends of the bolts 15a are guided by tubular sleeves 2d, which are attached to the left side wall 2b and the right side wall 2c at the height of the sleeves 53. The inner diameter of the sleeves 2d is larger than the outer diameter of the bolts 15a and may be, for example, by 0.1 mm to 2 mm larger than the outer diameter of the bolts 15a.

[171] A rotary movement of the shaft 514 by means of the hand lever 13 is converted into a linear movement of the piston members 502 via the levers 512 and the piston rod members 513. Due to the linear movement of the piston members 502, the holder 15A, 15B with the attached second receiving member 3 is moved back and forth between the opened state shown in Fig. 19, and the

closed state shown in Fig. 20. The linear movement of the holder 15A, 15B with the bolts 15a is guided and stabilized by the sleeves 503, 2d.

[172] In the following, a ninth embodiment will be described with reference to Figures 21 to 23. A multifunction connector 1H of the ninth embodiment substantially corresponds to the multifunction connectors 1, 1A, 1B, 1C, 1D, 1E, 1F, 1G of the first to eight embodiments. The multifunction connector 1H may comprise any one of the moving mechanisms 106, 206, 306, 406, 506, or the parallelogram mechanism 6, for moving the second receiving member 3 relatively to the first receiving member 2.

[173] In the multifunction connector 1H, a quick coupling 40 and a locking member 50 in the form of a spring latch are attached to the first receiving member 2 on the first surface 2af facing the second receiving member 3.

[174] In the present embodiment, the quick coupling 40 is a quick coupling of the “DUOMATIC” type (registered trademark), which comprises two horizontally arranged connections/ports for pneumatic lines. Alternatively, a different quick coupling may be used. The quick coupling 40 comprises a hand lever 41 and a cover 42. The cover 42 can be opened and closed by a pivoting movement of the hand lever 41. In a closed state, in which the hand lever 41 extends vertically upwards, the cover 42 covers the two connections/ports for the pneumatic lines. In the illustration shown in Figures 21 to 23, the quick coupling 40 is in the opened state, in which a connection of the second connection members 21 with the two connection ports of the quick coupling 40 is possible. In the opened state, the hand lever 41 extends rearward.

[175] The locking member 50 is arranged next to the quick lever 40, in particular, next to the hand lever 41. The locking member 50 comprises a holder 51 with a sleeve 52, which holder is bent in an L-shape when seen from above, and is attached to the first receiving member 2. A pin 53 is received in the sleeve 52. The pin 53 is rotatable about an axis along the longitudinal direction of the pin 53, and movable along the axis. An operating portion 54, by means of which operating portion the pin 53 can be rotated about the axis, is attached to one end of the pin 53. On the side where the operation portion 54 is attached to the pin 53

(left side in the Figures), the sleeve 52 has an inclined edge. The pin 53 is biased toward the other side of the sleeve 52 by means of a spring, such that the operating portion 54 is pressed against the inclined edge of the sleeve 52. On rotation of the pin 53 about the axis, the pin 53 is, thus, moved along the axis due to the interaction between the operating portion 54 and the inclined edge of the sleeve 52.

[176] In the illustration shown in Figures 21 and 23, the operating portion 54 extends upward. In this position, the pin 53 protrudes from the sleeve 52 on the right side, and blocks the hand lever 41 of the quick coupling 40 in the opened state. That is, the hand lever 41 cannot be pivoted upwards. Thus, the cover 42 is opened and second connection members 21 can be connected with the quick coupling 40. The second connection members 21 can be attached to the second receiving member 3, and can be biased toward the quick coupling 40 by means of zigzag springs 21b or other members. Figures 21 to 23 illustrate the opened state of the multifunction connector 1H. When the multifunction connector 1H is brought into the closed state by shearing of the illustrated parallelogram mechanism, the zigzag springs 21b press the second connection members 21 against the connections of the quick coupling 40, such that a – tight/opened – connection between lines 21a (not shown in Figures 21 and 23), which are attached to the second connection members 21, and lines 20a (not shown in Figures 21 and 23), which are attached to the connections of the quick coupling 40, is achieved. The zigzag springs 21b compensate a slight displacement of the second receiving member 3 away from the first receiving member 2 after passing the dead center of the parallelogram mechanism 6, and provide a tight connection between the second connection members 21 and the connections of the quick coupling 40. In the illustrated embodiment, a recess, through which the hand lever 41 of the quick coupling extends, is formed in the second receiving member 3.

[177] The assembly unit formed by the first receiving member 2 and the parallelogram mechanism 6 may also be used without the second receiving member 3. That is, second connection members 21, which are not attached to a

second receiving member 3, can be connected with the quick coupling 40. During such use, it is not required that the cover 42 of the quick coupling 40 is continuously opened. When the second connection members 21 are disconnected from the quick coupling 40, the cover 42 can be closed in order to protect the connections of the quick coupling 40. For this purpose, the operating member 54 is rotated such from the position shown in Figures 21 to 23 that, by engagement of the operating member 54 with the inclined edge of the sleeve 52, the pin 53 is moved leftward along the axis, i.e. the right end of the pin 53 is moved toward the sleeve 52. Thereby, the locking of the hand lever 41 of the quick coupling 40 is released, and the hand lever 41 can be pivoted upwards for closing the cover 42.

[178] In the present embodiment, the parallelogram mechanism 6 is used as a moving mechanism. The quick coupling 40 and the locking member 50 are, however, also compatible with any one of the other above-mentioned moving mechanisms.

[179] In the following, a tenth embodiment will be described with reference to Figures 24 to 28. A multifunction connector 1J of the tenth embodiment is formed similar to the multifunction connectors 1, 1A, 1B, 1H of the first to third and ninth embodiments. The multifunction connector 1J comprises the parallelogram mechanism 6 for moving a second receiving member 1003 relatively to a first receiving member 1002. The first receiving member 1002 is formed similar to the first receiving members 2, 2A, 2B and comprises the sleeves 2d, through which the front ends 15c of the bolts 15a are guided, as well as flat irons 2s. The second receiving member 1003 is formed similar to the second receiving member 3.

[180] A horizontally extending lower edge of the holders 15A, 15B respectively rests on the upper edge of the corresponding flat iron 2s, such that the holders 15A, 15B, are horizontally guided by the sleeves 2d, in addition to the guiding by the front ends 15c of the bolts 15a, during shearing of the parallelogram mechanism 6. The pins, which are guided by the second ends 9b of the first side members 9 and the second ends 10b of the second side members 10 of the left

and right sub-mechanisms 6a, 6b, are pivotably and vertically movable attached via ball bearings in respective elongate holes at the front and rear portions 8a, 8b of the holders 15A, 15B, such that the second ends 9b, 10b can move in the vertical direction during shearing of the parallelogram mechanism 6, while the holders 15A, 15B, which are guided by means of the sleeves 2d and the support on the flat irons 2s, can be moved horizontally towards and away from, respectively, the first receiving member 1002. Thus, the second distance D2 can be maintained substantially constant during shearing.

[181] On the side facing away from the first receiving member 1002, the flat irons 10d of the second side members 10 are respectively provided with an upwardly oriented hook 10h, which serves as a holder for receiving the hand lever 13. On its second end, which is formed as an open-end wrench, the hand lever 13 is provided with a hexagonal hole, which may serve for tightening and loosening nuts. In addition to the hole shown in Fig. 4, further holes of different sizes may be provided for different nuts of the multifunction connector 1J.

[182] The first receiving member 1002 is fixed to a holder 1060 which can be, for example, attached to a towing vehicle.

[183] As shown in Figures 25 and 27, the first and second receiving members 1002, 1003 have holes 2m, 3m formed in the first and second plates 2a, 3a. In the present embodiment, the holes 2m, 3m have a substantially square shape with rounded corners. The first receiving member 1002 is provided with six holes 2m. The second receiving member 1003 is provided with three holes 3m. The number and shape of the holes 2m, 3m may vary. As shown in Figures 26 and 28, adapter plates 70, 80 are attached to the first and second plates 2a, 3a in the region of the holes 2m, 3m, for example, by means of screws. The first and second holes 4, 5 for receiving the first and second connection members 20, 21 are formed in the adapter plates 70, 80. The adapter plates 80, which are mounted in the region of the holes 3m, protrude downward beyond the second plate 3a. In addition, further adapter plates 80 having second holes 5 for receiving the second connection members 21, which protrude downward beyond the second plate 3a, can be attached to a lower region of the second receiving member 1003. Moreover, in

accordance with the respective connection members 20, 21, adapter plates 70, 80 having different structures, in particular different thicknesses and differently shaped first and second holes 4, 5 may be used. Multiple adapter plates 70, 80 may be stacked. The quick coupling 40 shown in Figures 21 to 23 in connection with the ninth embodiment, can be attached to the adapter plates 70, 80, as illustrated in Figures 24 and 26.

[184] It is not necessarily required that the adapter plates 70, 80 are used for both the first receiving member and the second receiving member. For example, an adapter plate 70 can be attached to the first receiving member, to which, for example, the towing vehicle side part of the quick coupling 40 described in connection with the ninth embodiment is attached. The trailer side, complementary part, of the quick coupling 40 may be directly, i.e. without adapter plate, fixed to the second receiving member.

[185] A multifunction connector 1K of an eleventh embodiment is described with reference to Fig. 29. The multifunction connector 1K of the eleventh embodiment is similar to the multifunction connector 1A of the second embodiment. The multifunction connector 1K is provided with the hooks 10h for receiving the hand lever 13. The first receiving member 2 is attached to a holder 1061, which can be attached, for example, to a towing vehicle. The holder is L-shaped in a cross-second perpendicular to the left to right direction.

[186] In the illustrated embodiments, the right holder 15A and the left holder 15B are formed separately from each other. The right holder 15A and the left holder 15B may, however also be connected with each other, and, together, may form a single holder.

[187] The first receiving member 2 and/or the second receiving member 3 may have an integrated or attached collection tank for leakage oil/water. The collection tank may be attached on the first plate 2a and/or the second plate 3a, below the holes 4, 5.

[188] The moving mechanisms 106, 206, 306, 406, 506, 6 of the above-described fourth to eight embodiments are configured to linearly move the second receiving member 3, 1003 with respect to the first receiving member 2, 1002.

[189] Although the preferred embodiments of this invention have been described herein, improvements and modifications may be incorporated without departing from the scope of the following claims.

[190] The present disclosure further comprises the following aspects and further general embodiments, respectively, which particularly refer to Figures 8 to 23:

1. A multifunction connector (1C, 1D) for a vehicle or a vehicle trailer, or a system or a machine or a device for connecting and disconnecting connection members (20, 21) of lines (20a, 21a), comprising:
  - a first receiving member (2) for receiving at least one first connection member (20),
  - a second receiving member (3) for receiving at least one second connection member (21) connectable with the first connection member (20), and
  - a moving mechanism (106, 206) configured to move the second receiving member (3) substantially linearly along a connection direction of the first connection member (20) and the second connection member (21) between an opened state in which the first connection member (20) and the second connection member (21) are disconnected from each other, and a closed state in which the first connection member (20) and the second connection member (21) are connected with each other, relatively to the first receiving member (2), wherein the moving mechanism (106, 206) further comprises:
    - a holder (15A, 15B) for detachably attaching the second receiving member (3) to the moving mechanism (106, 206), and
    - a working cylinder (101, 201), which is a hydraulic cylinder (101) or a pneumatic cylinder (201) or an electric cylinder and comprises a piston rod (102, 202) which is movable in the connection direction of the first connection member (20) and the second connection member (21), wherein
      - the moving mechanism (106, 206) is configured to move the holder (15A, 15B) with the attached second receiving member (3) by moving the piston rod (102, 202) between the opened state and the closed state.

2. The multifunction connector (1C) according to aspect 1, wherein

- the moving mechanism (106) comprises a first sub-mechanism (106a) and a second sub-mechanism (106b), which are offset from each other by a third distance (D3) of at least 10 cm in a direction perpendicular to the connection direction of the first connection member (20) and the second connection member (21), and
- each of the first sub-mechanism (106a) and the second sub-mechanism (106b) comprises a working cylinder (101), which is a hydraulic cylinder (101) or a pneumatic cylinder (201) or an electric cylinder provided with a piston rod (102) which is movable in the connection direction of the first connection member (20) and the second connection member (21), and on which a holder (15A, 15B) for detachably attaching the second receiving member (3) to the moving mechanism (106) is provided.

3. The multifunction connector (1C, 1D) according to aspect 1 or 2, wherein the working cylinder (101, 201) is a double-acting cylinder having a first connection port (103) and a second connection port (104), and configured to

- move the holder (15A, 15B) with the attached second receiving member (3) to the closed state when a pressure medium is supplied to the first connection port (103), and
- move the holder (15A, 15B) with the attached second receiving member (3) to the opened state when a pressure medium is supplied to the second connection port (104).

4. The multifunction connector (1C) according to any one of the preceding aspects, wherein the holder (15A, 15B) is provided at the piston rod (102).

5. A multifunction connector for a vehicle or a vehicle trailer or a system or a machine or a device for connecting and disconnecting connection members (20, 21) of lines (20a, 21a), comprising:

- a first receiving member (2) for receiving at least one first connection member (20),

- a second receiving member (3) for receiving at least one second connection member (21) connectable with the first connection member (20), and

- a moving mechanism configured to move the second receiving member (3) substantially linearly along a connection direction of the first connection member (20) and the second connection member (21), between an opened state, in which the first connection member (20) and the second connection member (21) are disconnected from each other, and a closed state, in which the first connection member (20) and the second connection member (21) are connected with each other, relatively to the first receiving member (2), wherein the moving mechanism (106, 206) further comprises:

- a holder (15A, 15B) for detachably attaching the second receiving member (3) to the moving mechanism, and

- a hand lever (13) attached to the first receiving member (2),

wherein the moving mechanism is configured to move the holder (15A, 15B) with the attached second receiving member (3) between the opened state and the closed state by moving the hand lever (13).

6. The multifunction connector (1D) according to any one of claims 1 to 3 and 5, wherein the moving mechanism (206) further comprises:

- a shaft (214) which is attached to the first receiving member (2) and rotatable about an axis (X),

- a first lever (211) which is fixedly attached to the shaft (214) at its one end, and hingedly connected with the piston rod (202) or the hand lever (13) at its other end,

- a second lever (212) which is fixedly connected to the shaft (214) at its one end, and hingedly connected with the holder (15A, 15B) at its other end,

wherein the first lever (211), the shaft (214) and the second lever (212) are configured to convert a movement of the piston rod (202) or the hand lever (13) into a substantially linear movement of the holder (15A, 15B) with the attached second receiving member (3) along the connection direction of the first connection member (20) and the second connection member (21).

7. A multifunction connector (1E) for a vehicle or a vehicle trailer or a system or a machine or a device for connecting and disconnecting connection members (20, 21) of lines (20a, 21a), comprising:

- a first receiving member (2) for receiving at least one first connection member (20),

- a second receiving member (3) for receiving at least one second connection member (21) that is connectable with the first connection member (20), and

- a moving mechanism (306) configured to move the second receiving member (3) substantially linearly along a connection direction of the first connection member (20) and the second connection member (21) between an opened state, in which the first connection member (20) and the second connection member (21) are disconnected from each other, and a closed state, in which the first connection member (20) and the second connection member (21) are connected with each other, relatively to the first receiving member (2), wherein the moving mechanism (306) further comprises:

- a pinion (301), which is rotatably supported on the first receiving member (2),

- a rack (303), which is movable in the connection direction of the first connection member (20) and the second connection member (21) and meshes with the pinion (301), and

- a holder (15A, 15B), which holder is attached to the rack (302), for detachably attaching the second receiving member (3) to the moving mechanism (306),

wherein the moving mechanism (306) is configured to move the holder (15A, 15B) with the attached second receiving member (3) between the closed state and the opened state by means of rotation of the pinion (301) and a corresponding displacement of the rack (302).

8. A multifunction connector (1F) for a vehicle or a vehicle trailer or a system or a machine or a device for connecting and disconnecting connection members (20, 21) of lines (20a, 21a), comprising:

- a first receiving member (2) for receiving at least one first connection member (20),

- a second receiving member (3) for receiving at least one second connection member (21) that is connectable with the first connection member (20), and

- a moving mechanism (406) configured to move the second receiving member (3) substantially linearly along a connection direction of the first connection member (20) and the second connection member (21), between an opened state, in which the first connection member (20) and the second connection member (21) are disconnected from each other, and a closed state, in which the first connection member (20) and the second connection member (21) are connected with each other, relatively to the first receiving member (2), wherein the moving mechanism (406) further comprises:

- a holder (15A, 15B) for detachably attaching the second receiving member (3) to the moving mechanism (406), and

- a chain, rope or belt drive (401) comprising a first wheel (407), a second wheel (408) and a chain (409) and a rope or a belt, respectively, which extends around the first wheel (407) and the second wheel (408), and to which the second holder (15A, 15B) is attached, and configured to move the holder (15A, 15B) with the attached second receiving member (3) between the

closed state and the opened state by means of rotation of the first wheel (407) and the second wheel (408) and an associated movement of the chain (409) and the rope or belt, respectively.

9. The multifunction connector (1E, 1F) according to aspect 7 or 8, wherein the moving mechanism (306, 406) is provided with an application point (314a) for a detachably attachable lever (13), by means of which the pinion (301) and at least one of the first wheel (407) or the second wheel (408), respectively, can be rotated.

10. A multifunction connector (1G) for a vehicle or a vehicle trailer or a system or a machine or a device for connecting and disconnecting connection members (20, 21) of lines (20a, 21a), comprising:

- a first receiving member (2) for receiving at least one first connection member (20),
- a second receiving member (3) for receiving at least one second connection member (21) that is connectable with the first connection member (20), and
- a moving mechanism (506) configured to move the second receiving member (3) substantially linearly along a connection direction of the first connection member (20) and the second connection member (21), between an opened state, in which the first connection member (20) and the second connection member (21) are disconnected from each other, and a closed state, in which the first connection member (20) and the second connection member (21) are connected with each other, relatively to the first receiving member (2), wherein the moving mechanism (506) further comprises:

- a holder (15A, 15B) for detachably attaching the second receiving member (3) to the moving mechanism (506),
- a piston rod drive with a sleeve (503) that is attached to the first receiving member (2), a piston member (502) that is movably guided within the sleeve (503), on which piston member the holder (15A, 15B) is provided, and

a piston rod member (513) hingedly connected with the piston member (502) for sliding the piston member (501) within the sleeve (503), and

- a lever (512), which is movably supported on the first receiving member (2) at its one end, and hingedly connected with the piston rod member (513) at its other end,

wherein the moving mechanism (506) is configured to move the holder (15A, 15B) with the attached second receiving member (3) between the opened state and the closed state by means of a rotation of the lever (512) and an associated displacement of the piston member (502) by means of the piston rod member (513).

11. The multifunction connector (1G) according to aspect 10, wherein

- the moving mechanism (506) comprises at least one first sub-mechanism (506a) and at least one second sub-mechanism (506b), which are displaced from each other by a third distance (D3) of at least 10 cm in a direction perpendicular to the connection direction of the first connection member (20) and the second connection member (21), and further comprises a shaft (514), and

- each of the first sub-mechanism (506a) and the second sub-mechanism (506b) comprises a piston rod drive and a lever (512) with its end supported on the first receiving member (2) being fixedly connected with the shaft (514) such that a rotary movement of the shaft (514) is converted into a linear movement of the piston members (502) by means of the levers (512) and the piston rod members (513).

12. The multifunction connector (1G) according to aspect 10 or 11, wherein the moving mechanism (506) is provided with an application point (514a) for a detachably attachable hand lever (13), by means of which the lever (512) can be rotated.

13. A multifunction connector (1H) for a vehicle or a vehicle trailer or a system or a machine or a device for connecting and disconnecting connection members (20, 21) of lines (20a, 21a), comprising:

- a first receiving member (2) for receiving at least one first connection member (20),
- a second receiving member (3) for receiving at least one second connection member (21) that is connectable with the first connection member (20), and
- a moving mechanism configured to move the second receiving member (3) substantially linearly along a connection direction of the first connection member (20) and the second connection member (21), between an opened state, in which the first connection member (20) and the second connection member (21) are disconnected from each other, and a closed state, in which the first connection member (20) and the second connection member (21) are connected with each other, relatively to the first receiving member (2), wherein:

- on the first receiving member (2), a quick coupling (40) with a cover (42) that can be opened by means of a hand lever (41), which quick coupling serves as a first connection member (20), and a locking member (50) are attached,
- by means of the locking member (50), the hand lever (41) can be locked in a position in which the cover (42) is opened for connecting second connection members (21) with the quick coupling (40), and
- the second receiving member (3) is detachably attached to the moving mechanism.

14. The multifunction connector (1H) according to aspect 13, wherein the locking member (50) is a spring latch provided with a blocking member, e.g. a pin, and is configured to be displaced along an axis extending in the longitudinal direction of the blocking member (53), between a position, in which the blocking member (53) blocks a movement of the hand lever (41), and a

position, in which the blocking member (53) does not impair the movement of the hand lever (41), by means of rotating about said axis.

15. The multifunction connector (1C-1H) according to any one of the preceding aspects, wherein the first receiving member (2) is configured to receive at least two first connection members (20), and the second receiving member (3) is configured to receive at least two second connection members (21), wherein the connection directions of the first connection members (20) and the second connection members (21) are oriented in parallel with each other.

16. The multifunction connector (1C-1H) according to any one of the preceding aspects, wherein

- the first receiving member (2) or the holder (15A, 15B) is provided with a tubular sleeve (2d) oriented in parallel with the connection direction of the first connection member (20) and the second connection member (21), and

- the respective other one of the first receiving member (2) and/or the holder (15A, 15B) is provided with a bolt (15a) extending through the sleeve (2d) and oriented in parallel with the connection direction of the first connection member (20) and the second connection member (21).

17. The multifunction connector (1C-1H) according to any one of the preceding aspects, wherein the second receiving member (3) comprises a grip portion (3b).

18. The multifunction connector (1C-1H) according to any one of the preceding aspects, wherein

- the holder (15A, 15B) comprises two bolts (15a),
- the second receiving member (3) comprises two recesses (3c), and

- the second receiving member (3) can be attached to the holder (15A, 15B) by fitting the two recesses (3c) on the two bolts (15a).

19. The multifunction connector (1C-1H) according to any one of the preceding aspects, wherein

- the first receiving member (2) comprises a first plate (2a), in which at least one first opening (4) for receiving the at least one first connection member (20) is formed, and
- the second receiving member (3) comprises a second plate (3a), in which at least one second opening (5) for receiving the at least one second connection member (21) is formed.

20. An assembly unit configured to be coupled to a towing vehicle, and comprising a first receiving member (2) and a moving mechanism (6, 106, 206, 306, 406, 506) for a multifunction connector (1-1K) according to any one of aspects 1 to 19, wherein

- the first receiving member (2) is provided with a first plate (2a) having at least one first opening (4) for receiving a first connection member (20), and
- the moving mechanism (6, 106, 206, 306, 406, 506) is hinged to the first receiving member (2), and is configured to move a second receiving member (3) for receiving at least one second connection member (21) connectable with the first connection member (20), which second receiving member (3) is detachably attachable to the moving mechanism (6, 106, 206, 306, 406, 506), substantially linearly along a connection direction of the first connection member (20) and the second connection member (21).

21. The assembly unit according to aspect 20, wherein:

- a quick coupling (40) with a cover (42) to be opened by means of a hand lever (41), which quick coupling serves as a first connection

member (20), and a locking member (50) are attached to the first receiving member (2),

- by means of the locking member (50), the hand lever (41) can be locked in a position where the cover (42) is opened for connecting second connection members (21) with the quick coupling (40).

22. A second receiving member (3) for a multifunction connector (1-1K) according to any one of aspects 1 to 19, comprising:

- a second plate (3a), which is provided with at least one second opening (5) for receiving a second connection member (21), and
- a grip portion (3b).

23. Use of a multifunction connector (1-1K) according to any one of the preceding aspects in a dolly vehicle and a semitrailer, respectively, e.g. a refrigerated vehicle.

24. The multifunction connector according to any one of aspects 1 to 19 or claims 1 to 14, comprising an identification system (e.g. RF identification system, or safety switch with proximity sensor, or near field communication etc.), wherein

- a transmitter/reader/antenna is attached to one of the first and the second receiving members (2, 3),

- a receiver/transponder/chip is attached to the respective other one of the receiving members (3, 2), and

- the identification system is constructed such that

- on approximation, or connection, or use of complementary receiving members (2, 3), non-contact recognition or reading of a code, processing (e.g. in an evaluation unit), in addition to approval of the connection members (20, 21) (e.g. approval of a compressed air line and DUOMATIC, respectively, for operating a braking system; approval of power beyond connections for use and control; approval of hydraulic lines etc.), is effected, and

- on approximation, or connection, or use of non-complementary receiving members (2, 3), no approval is issued, such that, for example, a corresponding semitrailer, or trailer, or accessory equipment, or machine etc. cannot be used and applied.

25. The multifunction connector according to any one of aspects 1 to 19 and 24, wherein the first receiving member (2) consists of two or more parts.

26. The multifunction connector according to any one of aspects 1 to 19, 24 and 25, wherein the second receiving member (3) is formed of two or more parts.

[191] A multifunction connector according to above aspect 24 is, for example, advantageous with regard to theft-protection, and eliminates the danger of mistaking the vehicle (e.g. trailer) in much frequented logistics companies, large distribution halls, automotive groups with a variety of similar semitrailers and just in time service (right trailer with right load at the right place at the right time). An accurate control of the use of specific semitrailers, or trailers, or machines in case of a complex logistics center, or adverse weather conditions, or “language barriers” with regard to foreign driving personnel is achieved via GPS by the respective dispatcher. In case no approval is issued by the identification system, the respective semitrailer or trailer cannot be used. In case of no approval, an electrical line may, for example, be deactivated by an integrated switch, despite a mechanical connection between an associated first connection member and a second connection member. Approval is only possible if complementary receiving members are used. In case non-complementary receiving members are used, for example, a warning may be issued. The term “complementary receiving members” may comprise an authorization for coupling a respective semitrailer or trailer, which is provided with a second receiving member, to a towing machine provided with a first receiving member. In case

there is no authorization, the identification system does not issue an approval. The identification system may be combined with any one of the multifunction connectors according to the disclosed embodiments.

- [192] A multifunction connector according to above aspect 25 and/or 26 is, for example, advantageous under confined space conditions behind tractors and haulers, respectively.

## Claims

1. A multifunction connector (1) for a vehicle or a vehicle trailer, or a system, or a machine or a device for connecting and disconnecting connection members (20, 21) of lines (20a, 21a), comprising:
  - a first receiving member (2) for receiving at least one first connection member (20),
  - a second receiving member (3) for receiving at least one second receiving member (21) that is connectable with the first connection member (20), and
  - a parallelogram mechanism (6), which is configured to move the second receiving member (3) substantially linearly along a connection direction of the first connection member (20) and the second connection member (21) between an opened state, where the first connection member (20) and the second connection member (21) are disconnected from each other, and a closed state, where the first connection member (20) and the second connection member (21) are connected with each other, relatively to the first receiving member (2).
2. The multifunction connector according to claim 1, wherein the parallelogram mechanism (6) comprises:
  - a holder (15A, 15B) for detachably attaching the second receiving member (3) to the parallelogram mechanism (6),
  - a first side member (9), which connects the first receiving member (2) and the holder (15A, 15B) with each other, and is pivotable in a first plane in parallel to the connection direction of the first connection member (20) and the second connection member (21), relatively to the first connection member (2) and the holder (15A, 15B), and
  - a second side member (10), which connects the first receiving member (2) and the holder (15A, 15B) with each other, and is pivotable in a second plane, which is identical with or in parallel with the first plane, relatively to the first receiving member (2) and the holder (15A, 15B),

wherein the second side member (10) is offset relatively to the first side member (9) in the connection direction of the first connection member (20) and the second connection member (21).

3. The multifunction connector (1) according to claim 2, wherein

- the first side member (9) is hingedly connected with the first receiving member (2) at a first connection point (22a), and hingedly connected with the holder (15A, 15B) at a second connection point (22b),
- the second side member (10) is hingedly connected with the first receiving member (2) at a third connection point (22c), and hingedly connected with the holder (15A, 15B) at a fourth connection point (22d), and
- the connection points (22a-d) of the first side member (9) and the second side member (10) with the first receiving member (2) and the holder (15A, 15B) are arranged at the corner points of a parallelogram, when viewed in a direction perpendicular to the first plane and the second plane.

4. The multifunction connector (1) according to claim 2 or 3, wherein

- the first side member (9) comprises an elongate component, a first end (9a) of the elongate component of the first side member (9) being hingedly connected with the first receiving member (2) in the longitudinal direction of the first side member (9), and a second end (9b) of the elongate component of the first side member (9) being hingedly connected with the holder (15A, 15B) in the longitudinal direction,
- the second side member (10) comprises an elongate component, a first end (10a) of the elongate component of the second side member (10) being hingedly connected with the first receiving member (2) in the longitudinal direction of the second side member (10), and a second end (10b) of the elongate component of the second side member (10) being hingedly connected with the holder (15A, 15B) in the longitudinal direction, and

- the longitudinal direction of the elongate component of the first side member (9) is substantially in parallel with the longitudinal direction of the elongate component of the second side member (10).

5. The multifunction connector (1) according to any one of claims 2 to 4, wherein the parallelogram mechanism (6) further comprises:

- a rotary member (12) attached to the first receiving member (2) and rotatable about a first axis (X), which is perpendicular to the first plane and the second plane, relatively to the first receiving member (2), and
- an intermediate member (11) hingedly connected with the first side member (9), and hingedly connected with an eccentric portion of the rotary member (12),

wherein the intermediate member (11) is connected with the first side member (9) such that the first side member (9) is pivoted in the first plane relatively to the first receiving member (2), due to a movement of the intermediate member (11) associated with a rotation of the rotary member (12) about the first axis (X), and

wherein the intermediate member (11) and the rotary member (12) form a knee lever mechanism, the dead center of which is exceeded at the transition between the opened state and the closed state.

6. The multifunction connector (1) according to claim 5, wherein

- the parallelogram mechanism (6) comprises a first sub-mechanism (6a) and a second sub-mechanism (6b), which are offset with respect to each other by a third distance (D3) of at least 3 cm, in a direction perpendicular to the first plane and the second plane,

- each of the first sub-mechanism (6a) and the second sub-mechanism (6b) comprises a first side member (9), a second side member (10), an intermediate member (11), and a rotary member (12), and

- the rotary member (12) of the first sub-mechanism (6a) and the rotary member (12) of the second sub-mechanism (6b) are connected with each other via a shaft (14) that extends along the first axis (X).

7. The multifunction connector (1) according to claim 5 or 6, wherein the parallelogram mechanism (6) comprises a receiver for a load application device (13), and the rotary member (12) can be rotated about the first axis (X) by means of the load application device (13).

8. The multifunction connector (1) according to any one of the preceding claims, wherein the first receiving member (2) is configured to receive at least two first connection members (20), and the second receiving member (3) is configured to receive at least two second connection members (21), wherein the connection directions of the first connection members (20) and the second connection members (21) are in parallel with each other.

9. The multifunction connector (1A) according to any one of claims 2 to 8, wherein

- one of the first receiving member (2A) and the holder (15A, 15B), respectively, comprises a tubular sleeve (2d) oriented in parallel to the connection direction of the first connection member (20) and the second connection member (21), and
- the respective other one of the first receiving member (2A) and the holder (15A, 15B) comprises a bolt (15a, 15c) oriented in parallel with the connection direction of the first connection member (20) and the second connection member (21), and extending through the sleeve (2d).

10. The multifunction connector (1B) according to any one of claims 2 to 9, wherein

- the first side member (9) comprises two elongate flat irons (9d, 9e) that are arranged in parallel to each other, and

- the first receiving member (2B) comprises an elongate flat iron (2s) oriented in the connection direction of the first connection member (20) and the second connection member (21), and extending through a space between the two elongate flat irons (9d, 9e) of the first side member (9), which flat irons are arranged in parallel to each other.

11. The multifunction connector (1) according to any one of the preceding claims, wherein the second receiving member (3) comprises a grip portion (3b).

12. The multifunction connector (1) according to any one of claims 2 to 11, wherein

- the holder (15A, 15B) comprises two bolts (15a),
- the second receiving member (3) comprises two recesses (3c), and
- the second receiving member (3) can be attached to the holder (15A, 15B), by fitting the two recesses (3c) on the two bolts (15a).

13. The multifunction connector (1) according to any one of the preceding claims, wherein

- the first receiving member (2) comprises a first plate (2a), in which at least one first opening (4) for receiving the at least one first connection member (20) is formed, and
- the second receiving member (3) comprises a second plate (3a), in which at least one second opening (5) for receiving the at least one second connection member (21) is formed.

14. The multifunction connector according to any one of the preceding claims, wherein the parallelogram mechanism (6) comprises:

- a first side member (9) that is pivotable with regard to the first receiving member (2) in a first plane, which is in parallel with the connection

direction of the first connection member (20) and the second connection member (21), and

- a second side member (10) that is pivotable with regard to the first receiving member (2) in a second plane, which is identical with, or in parallel with, the first plane, wherein

when viewed in a direction perpendicular to the first plane and the second plane, the first side member (9) and the second side member (10) form two sides of a parallelogram, which sides are opposed to each other and in parallel with each other.

15. An assembly unit configured to be mounted to a towing vehicle, or a trailer/semitrailer, or an accessory equipment, or a system, or a device, or a machine, the assembly unit comprising a first receiving member (2) and a parallelogram mechanism (6) for a multifunction connector (1) according to any one of claims 1 to 14, wherein

- the first receiving member (2) comprises a first plate (2a) provided with at least one first opening (4) for receiving a first connection member (20), and

- the parallelogram mechanism (6) is hinged to the first receiving member (2), and configured to move a second receiving member (3) for receiving at least one second connection member (21) connectable with the first connection member (20), which second receiving member (3) is detachably attachable to the parallelogram mechanism (6), substantially linearly along a connection direction of the first connection member (20) and the second connection member (21).

16. A second receiving member (3) for a multifunction connector (1) according to any one of claims 1 to 14, comprising:

- a second plate (3a) provided with at least one second opening (5) for receiving a second connection member (21), and
- a grip portion (3b).