CLAIMS

1. An energy guide chain (1) for guiding lines like for example cables, hoses or the like comprising two parallel plate lines, wherein each plate line includes side plates (2, 3; 6) which are connected together by means of a flexible joint connector (5) and can be angled relative to each other, the flexible joint connector (5) is elastically deformable in a angulation direction of the side plates and the plate lines are connected together by transverse bars (4), wherein the side plates (2, 3; 6) include abutment surfaces which in the straight relative position of the side plates (2, 3; 6) bear against each other and include abutment surfaces which in the completely angled relative position of the side plates (2, 3; 6) bear against each other and wherein laterally protruding projections (21A, 21B; 31A, 31B) of a side plate (2, 3; 6) engage into recessed pockets (22A, 22B; 32A, 32B) of an adjacent side plate (2, 3; 6) and in the straight relative position (1B) at least first abutment surfaces (211A, 211B; 311A, 311B) of the projections cooperate with first counterpart abutment surfaces (221A, 221B; 321A, 321B) of the pockets and in the completely angled relative position at least second abutment surfaces (212A, 212B; 312A, 312B) of the projections cooperate with second counterpart abutment surface (222A, 222B; 322A, 322B) of the pockets and wherein all side plates (2, 3; 6) at least with their abutment surfaces are in themselves of a symmetrical configuration, characterised in that each side plate (2, 3; 6) has at least two projections (21A, 21B; 31A, 31B) having first and second abutment surfaces (211A, 211B; 311A, 311B and 212A, 212B; 312A, 312B) and at least two pockets (22A, 22B; 32A, 32B) having first and second counterpart abutment surfaces (221A, 221B; 321A, 321B and 222A, 222B; 322A, 322B) and that the two projections (21A, 21B; 31A, 31B) and the two pockets (22A, 22B; 32A, 32B) are provided symmetrically at the side plate (2, 3; 6), in particular in mirror-image symmetry relative to a heightwise plane (S1) or rotationally symmetrical relative to a heightwise axis (H; R) of the side plate (2, 3; 6).

2. An energy guide chain according to claim 1 characterised in that provided in both plate lines as side plates are respectively different outer plates (2) and inner plates (3) which alternate in the longitudinal direction of the chain, wherein both the inner plates (3) and also the outer plates (2) in relation to their heightwise

plane (S1) which extends perpendicularly to the longitudinal direction and which extends perpendicularly to the longitudinal direction of the chain and at least substantially perpendicularly to the side plates are respectively of a mirror-image symmetrical configuration in themselves with their abutment-operative abutment surfaces so that identical outer plates (2) and identical inner plates (3) can be used in both plate lines and that each outer plate (2) includes two projections (21A, 21B) and two pockets (22A, 22B) and each inner plate (3) includes two projections (31A, 31B) and two pockets (32A, 32B);

especially preferred wherein provided at the end on the inner plate or outer plate, in particular at the overlap region, are two oppositely disposed projecting stiffening extensions (33) which in the straight position respectively engage into a corresponding stiffening receiving means (23) at the central region of the connected outer or inner plate.

3. An energy guide chain according to claim 1 or claim 2 characterised in that the outer plates (2) and inner plates (3) in each case with respect to a longitudinal plane (S2) which extends in the longitudinal direction (L) of the chain and at least substantially perpendicularly to the side plates (2, 3) in particular through the joint connector or connectors (5), has two mutually opposite heightwise regions and provided at the outer plates (2) and inner plates (3) are respective projections (21A, 21B; 31A, 31B) in the one heightwise region and pockets (22A, 22B; 32A, 32B) are provided in the other opposite heightwise region.

4. An energy guide chain according to one of the preceding claims, in particular according to claim 2, wherein the transverse bars (4) with the side plates (2) define a receiving space for lines to be guided, characterised in that at least two projections (21A, 21B; 31A, 31B) of a side plate (2, 3) project away from the receiving space and at least two abutment pockets (22A, 22B; 32A, 32B) of said side plate (2, 3) open towards the receiving space, or vice-versa, and in particular that the pockets (22A, 22B) of the outer plates (2) open towards the receiving space and the projections (21A, 21B) of the outer plates (2) project away from the receiving space and the pockets (32A, 32B) of the inner plates (3) open towards the receiving space and the projections (31A, 31B) of the inner plates (3) project away from the receiving space.

5. An energy guide chain according to claim 1 characterised in that there are provided in both plate lines continuously successive structurally identical side plates (6) which are rotationally symmetrical at least with their abutment-operative abutment surfaces in relation to a heightwise axis (H/R) which extends perpendicularly to the longitudinal direction (L) of the chain and at least substantially parallel to the side plates (6), preferably in the central plane thereof;

in particular wherein the side plate (6) has two projections (61C, 61D) which project away from the receiving space and two projections (61A, 61B) which project towards the receiving space and the side plate has two pockets (62A, 62B) which open towards the receiving space and two pockets (62C, 62D) which open away from the receiving space.

6. An energy guide chain according to one of the preceding claims, in particular according to claim 2, characterised in that the transverse bars (4) are fixed releasably to transverse bar receiving means (40) of the side plates, in particular at the outer plates (2), wherein preferably each of the transverse bar receiving means forms a clamping receiving means (40) which is in one piece with the side plate having two clamping surfaces (40A, 40B) which are in opposite relationship in the longitudinal direction (L) of the chain and between which a fixing portion (41) of complementary shape of the transverse bar is or can be clamped, wherein the clamping surfaces preferably include a convex latching region.

7. An energy guide chain according to one of the preceding claims, in particular according to claim 3, wherein the energy guide chain guides lines between connecting locations, of which at least one is moveable relative to the other and the energy guide chain is displaceable upon relative movement of the connecting locations with the formation of an upper run (1B), in particular a self-supporting upper run (1B), and a lower run (1A) which merge into each other by way of a direction-changing region (1C) and wherein the side plates (2, 3) have narrow sides which extend substantially in the longitudinal direction (L) and face away from each other and wherein preferably

- the narrow sides which are inward in the direction-changing region or face towards the respective other run form a rectilinear support (8) which is interruption-free in the longitudinal direction, and/or

- the narrow sides of the side plates, that are outward in the direction-changing region or face away from the respective other run, in particular of the side plates, include a deformable damping region (9) for damping the transition of the direction-changing region into the lying lower run;

wherein the damping region (9) most preferably includes a bridge-shaped spring element which is formed in one piece with the narrow side of the side plate and which is connected at both sides to the narrow side.

8. An energy guide chain according to one of the preceding claims characterised in that two adjacent side plates (2, 3) are respectively connected together by a separate joint connector (5) or a longitudinal portion with three or more side plates (2, 3) are connected together by a common joint connector.

9. An energy guide chain according to one of the preceding claims, in particular according to claim 2, characterised in that each side plate (2, 3; 6), in particular the inner plate and the outer plate (2, 3), respectively has a thickened central region (20, 30) and adjoining same at least two thinner overlap regions (20A, 20B; 30A, 30B), with which the side plates, in particular the inner and outer plates, overlap in the longitudinal direction (L), wherein further end abutment surfaces which face substantially in the longitudinal direction are provided at the end at the central region (202A, 202B; 301A, 301B) and at the end at the overlap regions (201A, 201B; 302A, 302B) to cooperate in abutment-operative relationship.

10. An energy guide chain according to one of the preceding claims characterised in that the first and second abutment surfaces (211A, 211B; 311A, 311B and 212A, 212B; 312a, 312b) and cooperating therewith first and second counterpart abutment surfaces (221A, 221B; 321A, 321B and 222A, 222B; 322A, 322B) and preferably the further end abutment surfaces (202A, 202B; 301A, 301B; 201A, 201B; 302A, 302B) are of a mutually congruently convexly or

concavely curved configuration and in particular are curved continuously and/or steadily.

11. An energy guide chain according to one of the preceding claims, in particular according to claim 10, characterised in that the respectively connected side plates (2, 3) are held to each other by the joint connector (5) with a lateral air gap (G), in particular with a lateral air gap (G) between the opposing overlap regions (20A, 20B; 30A, 30B).

12. An energy guide chain according to one of the preceding claims characterised in that provided at least at a thickened central region (20, 30) of the side plate is at least one material recess (24, 34) having a plurality of defining surfaces, in particular predominantly with concavely curved surfaces.

13. A side plate (2, 3; 6) for an energy guide chain, in particular according to claim 1, in particular an outer plate (2) or inner plate (3) for an energy guide chain according to claim 2, wherein a plurality of side plates can be connected together by means of a flexible joint connector (5) to constitute a plate line and can be angled relative to each other and wherein the side plate (2, 3) includes laterally protruding projections and corresponding recessed pockets in order upon connection of two side plates in a straight relative position to cause at least first abutment surfaces of the projections to cooperate with first counterpart abutment surfaces of the pockets and in the completely angled relative position to cause at least second abutment surfaces of the projections to cooperate with second counterpart abutment surfaces of the pockets, **characterised in that** the side plate at least with its abutment surfaces is in itself of a symmetrical configuration and includes at least two projections (21A, 21B; 31A, 31B) with first and second abutment surfaces and at least two pockets (22A, 22B; 32A, 32B) with first and second counterpart abutment surfaces, wherein the two projections and the two pockets are provided symmetrically on the side plate, in particular in mirror-image symmetry relative to a heightwise plane (S1) at the outer or inner plate or rotationally symmetrically relative to a heightwise axis (H, R) of the side plate, wherein one side or side surface of the side plate (2, 3; 6) has the at least two

pockets and the other side or side surface of the side plate (2, 3; 6) has the at least two projections.

14. A side plate according to claim 13 characterised by at least one characterising feature according to one of claims 2 to 12.

15. An energy guide chain or side plate according to one of the preceding claims characterised in that each side plate (2, 3; 6) is made in one piece from plastic and preferably the or each joint connector (5) is produced separately from another permanently elastic or more flexible plastic than the side plates.

16. An energy guide chain or side plate according to one of the preceding claims characterised in that two respective side plates are connected by a joint connector (5), wherein the side plates have fixing receiving means (25; 55) which are open in the longitudinal direction and in which a respective fixing end of the joint connector is fixed, in particular being pressed therein, and wherein preferably the joint connector is sized with an overlength such that the joint connector is compressed in the straight position of the run.

17. A joint connector (5) for an energy guide chain or side plate according to one of the preceding claims wherein the joint connector (5) has a plate-like body with an elastically flexible central joint region (52) which is adapted to connect adjacent side plates (2, 3) together in such a way that they can be angled, and which in particular has two material regions (521, 522) which are curved outwardly in opposite relationship and having a hollow space (523) which is disposed between them and is open at both sides, and wherein the body for fixing in a corresponding fixing receiving means (25, 35) of a side plate includes two mutually opposite end fixing regions (51A, 51B) with a cross-section which enlarges towards the ends, **characterised in that** the fixing region (51A, 51B) at least at its end facing in the longitudinal direction includes a flattened and/or curved contact surface (54), the radius of curvature of which is markedly greater than half the largest cross-sectional dimension of the fixing region;

preferably wherein the cross-section of the fixing region (51A, 51B) is designed for a positively locking connection which is non-rotatable in the

corresponding fixing receiving means (25, 35) upon angulation or in appropriate bending; wherein in particular the cross-section of the fixing region (51A, 51B) is of a substantially trilobular or approximately triangular configuration.

18. A joint connector according to claim 17 characterised in that the body has a plate-like transitional region (53) between each fixing region and the central joint region (52); and/or

in that the joint connector (5) is made in one piece from plastic, in particular a flexurally elastic plastic.

19. An energy guide chain or side plate according to one of claims 1 to 16 characterised by joint connectors (5) according to claim 17 or 18, which respectively connect together two side plates adjacent in the longitudinal direction.

20. An energy guide chain (101) for guiding lines like hoses, cables or the like comprising a plurality of hingedly interconnected chain links (102, 102') which form a receiving space (102a) for receiving and guiding the at least one line, wherein the chain links (102, 102') have oppositely disposed plates (103, 103') having inner and outer side surfaces (104a, 104b) and narrow sides (105a, b) substantially parallel to the longitudinal direction of the energy guide chain, wherein at least some of the links (102, 102') have at least one transverse bar (120) which releasably connects the plates (103, 103') together and which at both oppositely disposed end regions (121) has fixing means (122) for releasable fixing to a plate (103, 103') of the respective chain link (102, 102'), and wherein the plates (103, 103') respectively have fixing means (108) for releasably fixing the corresponding transverse bar fixing means (122), wherein moreover the plates (103, 103') have joint connections (109) which can be hingedly connected together with corresponding joint connections (109) of the plates (103') of the adjacent chain link (102') optionally by means of separate joint elements (110), wherein the hingedly interconnected plates of chain links arranged in succession in the longitudinal direction of the chain form at least two laterally mutually spaced plate lines (150, 160) which extend in the longitudinal direction of the chain and between which is arranged at least a part of the receiving space (120a) for the at least one line, and wherein successive chain links of the energy guide chain are variable in

position relative to each other by virtue of the joint connections (109) between adjacent links (102) or plates (103), wherein the plates include abutment surfaces which bear against each other in a straight relative position of the plates and abutment surfaces which bear against each other in a completely angled relative position of the plates, **characterised in that** extending continuously over a chain portion (130) which includes at least more than three adjacent chain links (102) and which includes the at least two or all of the plate lines (150, 160, 170) the plate lines are overall made up continuously from structurally identical plates, which are rotationally symmetrical at least with their abutment-operative abutment surfaces in relation to a heightwise axis (H/R) which extends perpendicularly to the longitudinal direction (L) of the chain and at least substantially parallel to the plates, preferably in the central plane thereof, so that the respective plate (103) can be arranged selectively at any position at each of the various lines of the chain portion;

preferably wherein the plates (103, 103') of the chain portion (103) have fixing means (108) for the at least one transverse bar (120), which are arranged in the region of at least one of the plate narrow sides (105a. b) and are of such a configuration that the transverse bar (120) can be selectively fixed to the plate (103, 103') projecting from the inner plate side or from the outer plate side; and/or

preferably wherein the plate fixing means (108) for the respective or all transverse bars (120) of the plate (103, 103') are permanently and non-releasably provided on the respective plate (103, 103'), most preferably being formed in one piece on the plates (103, 103').

21. An energy guide chain according to claim 20 characterised in that the plates (103, 103') of the chain portion (130) have joint connections (109) and that the respective plate (103, 103') has at least one joint element (110) which in cooperation with an adjacent plate (103, 103') forms a joint connection (109) and the plate (103, 103') has at least one joint element (110) which is permanently connected to the plates (103, 103'), preferably being formed thereon in one piece; and/or

in that the respective plates (103, 103') at at least one end thereof include a joint element (110) which cooperates with an adjacent structurally identical plate (103, 103'), providing a joint connection (109) between the plates (103, 103').

22. An energy guide chain according to claim 20 or 21 characterised in that the plates (103, 103') of the chain portion (130) have abutments (112) which cooperate with corresponding abutments (113) of the respectively adjacent chain link for limiting the joint movement of adjacent plates relative to each other and the abutments (112, 113) are permanently connected to the plates, preferably being formed thereon in one piece.

23. An energy guide chain according to one of claims 20 to 22 characterised in that the chain portions (130) including the lines of plates (150, 160, 170) are overall made up continuously from plates (103) which in adjacent or different plate lines (150, 160, 170) of the chain (101) can be imaged on to each other by translative displacement along the direction in which the transverse bars extend.

24. An energy guide chain according to one of claims 20 to 23 characterised in that the chain portions (130) including the lines of plates (150, 160, 170) are overall made up continuously from plates (103) which are rotationally symmetrical in themselves, more specifically in relation to an axis of rotation (R1) which extends perpendicularly to the longitudinal direction (L1) of the plate (103) and at least substantially parallel to the plate side surfaces (104a, b) and which preferably extends in the central plane (M1) of the plate.

25. An energy guide chain according to one of claims 20 to 24 characterised in that the plates have damping elements adapted for abutment damping upon adjacent plates of a line of plates butting against each other.

26. An energy guide chain according to one of claims 20 to 25 characterised in that the chain (101) has three or more laterally mutually spaced plate lines (150, 160, 170) extending in the longitudinal direction of the chain and that provided continuously over at least a plurality of adjacent chain links is a chain portion (130) in which the at least three plate lines (150, 160, 170) extending in the longitudinal direction of the chain are designed in accordance with one of claims 20 to 25;

in particular wherein in respect of a first pair of adjacent first and second plate lines (150, 160) first chain links (102a) are provided, wherein the plates (103) arranged in different plate lines (150, 160) are connected together with transverse bars (120) releasable at both end regions, thereby providing chain links (120a) , and there are provided second chain links (120b) in respect of which the plates arranged in different plate lines (150, 160) are not connected together with transverse bars, and in the two adjacent first and second plate lines (150, 160) first and second chain links (102a 102b) are arranged in succession in the longitudinal direction of the chain and that in respect of a further third plate line (170) of the energy guide chain (101) there are provided said first and second chain links (102a, 102b) which are disposed in succession in the longitudinal direction of the chain, that the second plate line (160) is arranged between the first and the third plate line (150, 170) and that provided at the second plate line (160) are plates (130) which are releasably connected by means of transverse bars (120), preferably only to plates of the first plate line (150), and the second plate line (160) further has plates (103) which are releasably connected by means of transverse bars (120), preferably only to plates of the third plate line (170).

27. An energy guide chain according to claim 26 characterised in that there are provided three or more plate lines (150, 160, 170), wherein at least one plate line (160) is arranged between two adjacent plate lines (150, 170), forming a first, a central second and a third plate line, wherein the second plate line (160) is releasably connected with transverse bars to the two adjacent plate lines (150, 160) and (i) selected plates (103) of the second plate line are either connected only to plates of the first plate line or only to plates of the third plate line, or (ii) selected plates (103) of the second plate line (160) are releasably connected with transverse bars (120) to plates of both adjacent plate lines (150, 170); and/or

characterised in that there are provided three or more plate lines (150, 160, 170), wherein at least one plate line (160) is arranged between two adjacent plate lines (150, 160), forming a first, a central second and a third plate line, wherein the second plate line (160) is releasably connected with transverse bars (120) to the two adjacent plate lines (150, 170) and the second plate line (160) has plates (103) which at one of the plate narrow sides (105a) of the respective plate (103) is connected by means of a releasable transverse bar (120) to the first plate line

(150) and at the other narrow side (105b) of the same plate (103) is connected by means of a releasable transverse bar (120) to the third plate line (170).

28. An energy guide chain according to claim 26 or 27 characterised in that the plates (103) of the at least three adjacent plate lines are designed according to one of claims 20 to 24 and that preferably in the chain portion including a plurality of chain links the plates of the three adjacent plate lines are of the same structural configuration.