

"AN APPARATUS FOR GUIDING FLEXIBLE SUPPLY LINES"

This invention relates to an apparatus for guiding flexible supply lines held by a guide chain which is connected on the one hand to a stationary connection point and on the other hand to a movable supply point
.5 and of which the excess length is taken up and deposited in a loop during movement of the supply point.

Drag chains of this type consist of a plurality of chain links within which flexible supply lines are guided (see German Gebrauchsmuster No. 6,604,853).
10 Minimum bending radii which must not be reduced are determined by the manufacturer of such supply lines to ensure reliable transportation of the medium to be conveyed over a long period.

For this purpose, the chain links have stops on
15 which the chain links rest and which therefore prevent the drag chain from falling below a certain radius of curvature in the region of a loop. It is therefore necessary to produce different chain links for various prescribed minimum bending radii of the supply lines.
20 This makes the manufacture and storage of the chain links very expensive. It is also necessary to observe precise tolerances in the stops to obtain a specific radius of curvature. Moreover, it has been found that

these stops are stressed very greatly at the high frequencies and speeds of movement of the type to be encountered, for example, in maintenance devices on open end spinning machines, so that the radius of curvature predetermined for the guide chain cannot be guaranteed for a long time.

The object of the invention is therefore to devise a holder for guiding flexible supply lines which avoids these drawbacks.

10 It is thus proposed according to the invention that the curvature of the loop should be predetermined by a deflection chain wheel which is supported on one part of the guide chain so as to unroll freely on this part of the chain and be entrained by movement of the guide
15 chain. Consequently, it is not the chain links which ensure that the prescribed minimum bending radius of the supply lines is not reduced but the chain wheel which supports the guide chain in the deflection region formed by the loop. The chain links need not therefore have
20 co-operating stops and can be used for the most varied minimum bending radii of the supply lines such the guide chain is provided with a smaller or larger chain wheel as required. Over-stressing of the lines is avoided by observing these minimum bending radii for a long time.
25 The torsion stresses produced by over-stressing, which cause the supply lines to lie on top of each other and thus increase further the stress in the supply lines

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do not occur in the supply lines either. The chain links do not therefore need to have separating webs or the like between the individual supply lines so that, when using the chain wheel according to the invention
5 which is guided freely in the loop of the guide chain, not only can smaller chain links be used but these can also be even simpler in design.

Depending on the length of the movement section and depending on the design of the guide chain and depending
10 on the drive of the guide wheel together with the loop formed by the guide chain, it may be advantageous if the chain wheel has a guide means. This guide means can be designed in different ways, but should produce minimal friction during movement of the guide chain and the
15 chain wheel. According to a preferred embodiment of the invention, the chain wheel is arranged vertically, but the invention is not restricted to this arrangement. Thus, the chain wheel can also assume any other desired, for example even oblique, orientation.

20 A horizontal arrangement of the chain wheel is extremely advantageous for many purposes as it is particularly suitable for an under-floor installation. The front face of the chain wheel is preferably designed as a sliding face by which the chain wheel is supported
25 on rolling bearings and these bearings can be arranged in the base for the chain wheel or in the chain wheel itself.

In practice, it is advantageous if the laid out guide chain is located in a box-like rail. In this instance the guide means for the chain wheel is preferably formed by a box-like rail which holds the guide chain at least in part.

If the consumer requires a large number of supply lines, the guide chain has quite wide chain links. To reinforce such chain links, it is usual to support them in the transverse direction by webs. In contrast to the formerly conventional guide chains in which these transverse webs are required even with chains of small widths, to avoid damaging the supply lines, these transverse webs only have the object of mechanically reinforcing the wide chain links. The chain wheel is preferably designed with several tracks in adaptation to this division. With large chain lengths and large chain widths, it is advantageous if a separate guide chain is provided for each track of the chain wheel. This permits further standardisation of the chain links , making the manufacture even more economical. Guide means for the chain wheel can be provided between the guide chains.

The chain wheel need not be a solid wheel in each case as it is generally sufficient if the chain wheel is designed as a ring.

The chain wheel according to the invention in the loop of the guide chain permits the design engineer

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to design the chain links of the guide chain merely according to the requirements with respect to dimensions of and loading by the supply lines stored in them, whereas the prescribed minimum bending radius is irrelevant. It is sufficient to use the correspondingly dimensioned chain wheel for the respectively prescribed minimum bending radius. The guide chain need not be exchanged either if an additional supply line requiring a larger minimum bending radius than the previously provided supply lines is used in the guide chain for the consumer later on, but rather it is sufficient to exchange the chain wheel for one of suitable diameter. As the chain links do not have to meet any particular requirements with respect to tolerances, any modifications thereof by wear do not affect the reliability of operation and the protection of the supply lines guided through the guide chain.

The invention is illustrated in more detail hereafter with reference to embodiments and drawings.

20 Figure 1 is a side view of a guide chain with a loop arranged in a vertical plane which is supported by an annular chain wheel according to the invention.

Figure 2 is a cross-section of a detail of a specific embodiment of the apparatus shown in Figure 1.

25 Figure 3 is a side view showing the mode of use of the invention when the consumer is moving horizontally and the loop of the guide chain is vertical.

Fig. 4 is a cross-section through an embodiment of the invention which is particularly suitable for an under-floor arrangement.

The apparatus for guiding flexible supply lines 10, 11 and so forth, is described first of all with reference to Figure 1. These supply lines 10, 11, 12 (see also Figure 4) which connect a stationary connection point 1 to a supply point 7 movable thereto can serve for guiding electric current but also a gaseous, powder-form or liquid medium. The supply lines 10, 11, 12 are guided in the chain links 20 of a guide chain 2 whose length corresponds to the distance to be bridged over when the supply point 7 is located in its end position most remote from the connection point 1. The excess length during the movement of the supply point 7 is taken up in a loop 21 whose size thus changes as a function of the change of position of the supply point 7. The loop 21 surrounds a chain wheel 3 which engages by its teeth 30 with the chain links 20 of the guide chain 2 and therefore rolls together with the guide chain 2. As the consumer 12 is located higher than the connection point 1, the chain wheel 3 is arranged vertically. The chain wheel 3 in the embodiment illustrated is an annulus in order to save material and weight.

As shown in Figure 1, the chain wheel 3 is looped by the guide chain 2 in the deflection region. As the

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chain wheel 3 meshes with the guide chain 2, the chain wheel 3 is forced to follow the movement of the supply point 7, the rolling speed of the guide chain 2 and thus of the chain wheel 3 only being half as much as the speed of the supply point 7, as the path covered by the supply point 7 is divided between the two portions of the loop 21 of the guide chain 2.

When the supply point 7 moves away from the chain wheel 3, a tension is exerted on the upper portion of the guide chain 2, and causes rolling of the guide chain 2. During the opposite movement of the supply point 7, the supply point 7 acts on the guide chain 2 by pushing. Owing to its dead weight and the weight of the supply lines 10, 11, 12 and so forth, accommodated by it, the guide chain 2 sags, so that the two portions of the loop 21 of the guide chain 2 lie on each other during the pushing movement. The sagging guide chain 2, however, forms the radius of curvature predetermined by the wheel so that there is no risk of the permissible minimum bending radius of the supply lines 10, 11, 12, being reduced.

During the movement of the supply point 7, the guide chain 2 is deposited in a box-like rail 4. Depending on the length of the guide chain 2, this involves not only the portion of the guide chain 2 between the connection point 1 and the chain wheel 3 but, particularly during the pushing movement due to the weight, also the

bending intermediate region of the portion of the guide chain 2 between the chain wheel 3 and the supply point 7 with the supply lines 10, 11, 12 and so forth, arranged in it.

5 The side wall 40 of the box-like rail 4 is of such a height in the embodiment illustrated that it takes up the two superimposed portions of the guide chain 2. In this way, the side wall 40 of the rail 4 also extends to the front faces 34, 37 of the chain wheel 3 (see Figure 10 2) so that the box-like rail 4 forms a lateral guide for the chain wheel 3.

In the embodiment illustrated, the supply point 7 moves horizontally and also parallel to the rail 4. However, it is also possible to move the supply point 7 15 over an inclined path and/or obliquely to the rail 4 if sufficient looping of the chain wheel 3 by the guide chain 2 is permitted. During movement of the supply point 7, the chain wheel 3 is moved together with the guide chain 2 by the meshing of the teeth 30 in the 20 chain links 20 in such a way that it is invariably located in the deflection region of the guide chain 2. The chain wheel 3 thus ensures that the portion of the guide chain 2 in which the supply lines 10, 11, 12 and so forth, arranged in it are most at risk, namely its 25 deflection region, is supported so that the prescribed minimum bending radius of the supply lines 10, 11, 12 etc., can never be reduced.

If sufficient looping of the chain wheel 3 is always allowed, the guide means can sometimes also be dispensed with, however, it is extremely advantageous, particularly with heavy guide chains 2, with large radii of the chain wheels 3 or even when the apparatus is arranged on or against unevenly running machines. With apparatus in which the loop 21 is nearly unrolled with the supply point 7 at the greatest distance from the connection point 1, a guide means for the chain wheel 3 should be provided to prevent the chain wheel 3 which is substantially released by the guide chain 2 from tipping over and disengaging from the chain wheel 2. For this purpose, it is sufficient to guide the chain wheel 3 between two parallel walls.

Another embodiment with horizontal movement of the supply point 7 and vertical design of a loop 21 is shown in Figure 3. The supply point 7 moves on a horizontal guide rail 13 while a link guide 41 with a vertical guide slot 42 in which the chain wheel 36 is guided by means of its axis 31 is provided for the chain wheel 36. The chain wheel 36 has a hub (not shown) for taking up the axle 31, for which purpose it is either designed as a solid wheel or has spokes for connecting the ring to the hub in the case of an annular design.

The guide chain 2 is again connected to a stationary connection point 1 and is guided round a stationary deflection guide means 14 to the chain wheel 36 from

where the guide chain 2 is guided via a stationary chain wheel 32 to the supply point 7. In the embodiment illustrated, the link guide means 41 having the guide slot 42 possesses an extension arm 43 which holds the stationary chain wheel 32. With this design of the invention, the guide chain 2 is held under tension due to the force of gravity.

The guide chain 2 can be guided in an encapsulated duct 8, regardless of the direction in which the guide chain 3 or 36 is orientated (Figure 4). Depending on the amount of space available and depending on the application, it is often desirable to orientate the loop 21 horizontally. Such an embodiment is shown in Figure 4.

In this Figure, an encapsulated duct 8 is provided for accommodating and guiding the chain wheel 36 and the guide chain 2, in which duct 8 the guide chain 2 is guided in such a way that the two portions of the guide chain 2 forming the loop 21 cannot move further apart than in the tensioned state. During the pushing action, it is merely possible for the two portions to rest against each other as already described with reference to the design according to Figure 1, where such resting of the two chain portions is caused by sagging.

According to Figure 4, the duct 8 is provided in the ground 80 (i.e. under the floor). A chain link 20 is connected via a laterally mounted catch 22 to the supply

point 7 for which the upper duct wall 81 has a longitudinal slot 82. Further roller bearings 35 can be provided between this upper duct wall 81 and the upper end face 37 of the chain wheel 3.

5 In the illustrated under-floor arrangement of the guide chain 2 and the chain wheel 3, the catch 22 is arranged on the side of the chain link 20, so it goes without saying that, depending on the reciprocal arrangement of the guide chain 2 and the supply point 7,
10 such a one can also be provided on the radially external side of the guide chain 2. The longitudinal slot 82 is accordingly provided in the duct 8 which can obviously also be provided above the floor within an installation or machine.

15 If the chain wheel is exchanged for one of a different diameter with radial guidance of the chain wheel 3 or 36, it is sufficient to adapt the guide means 5 by adjusting a side wall of the duct 8 to the new diameter.

20 According to Figure 4, the end face 34 of the annular chain wheel 3 is designed as a sliding face on which the chain wheel 3 is supported by rolling bearings 35 (for example balls). It is immaterial whether the bearings 35 are arranged in the chain wheel 3 or in the
25 guide means 5. In the design illustrated, the rolling bearings 35 are arranged in the chain wheel 3 as fewer bearings 35 are required in this case than in the case where the bearings 35 are arranged in the guide 5.

If the guide chain 2 is held under tension by the chain wheel 3 or 36 due to the force of gravity and need not be driven by the guide chain 2, a multiple arrangement of loops 21 next to each other is possible, such a chain wheel 36, 32 being provided on each deflection point (see also Figure 3).

If many supply lines 10, 11, 12 and so forth, are provided it may be advantageous to provide transverse webs for reinforcing the chain links 20, which transverse webs have the additional side effect of separating the supply lines 10, 11, 12. In such a case, it is desirable to design the chain wheel 3 or 36 with several tracks. Such a design of chain wheel 3 is shown in Figure 2, as can be seen clearly by the teeth 30 and 38. The connection points 1 for each guide chain 2 or 23 can also be offset in their direction of movement, in which case care should be taken that the chain wheel 3 or 36 never moves beyond the connection point 1 nearest to it.

Depending on the operating conditions and depending on the type of supply lines, it may be advantageous to provide various guide chains 2, 23 for the supply point 7 (see Figure 2). According to Figure 2, these two guide chains 2, 23 are separated from each other by a guide means 44 which also serves to guide the chain wheel 3 in addition to guiding the guide chain 2 and 23.

Further modifications of the subject of the invention by exchange of individual features for each other or for equivalents and combinations thereof fall within the scope of the present invention as defined by 5 the appended claims.

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CLAIMS

1. An apparatus for guiding flexible supply lines which are connected on the one hand to a stationary connection point and on the other hand to a movable supply point and are held by a guide chain, the excess length of the flexible supply lines being taken up and deposited in a loop during movement of the supply point, the curvature of the loop being predetermined by a deflection chain wheel, characterised in that the deflection chain wheel is supported on one part of the guide chain so as to unroll freely on this part of the chain and being entrained by movement of the guide chain.
2. An apparatus according to Claim 1, characterised by guide means allocated to the chain wheel.
3. An apparatus according to Claim 1 or Claim 2, characterised in that the chain wheel is vertically arranged.
4. An apparatus according to Claim 1 or Claim 2, characterised in that the chain wheel is horizontally arranged.
5. An apparatus according to Claim 3 or Claim 4, characterised in that the front face of the chain wheel is a sliding face by which the chain wheel is supported on rolling bearings.



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6. An apparatus according to any of Claims 1 to 5, characterised in that the guide means is formed by a box-like rail which at least in part takes up the guide chain.
7. An apparatus according to any of Claims 1 to 6, characterised in that the chain wheel has several tracks.
8. An apparatus according to Claim 7, characterised by a separate guide chain for each track of the chain wheel.
9. An apparatus according to Claim 8, characterised in that the guide means for the chain wheel is situated between the guide chains.
10. An apparatus according to any of Claims 1 to 9, characterised in that the chain wheel is an annulus.
11. An apparatus for guiding flexible supply lines substantially as hereinbefore described with reference to, and as shown in, any of the accompanying drawings.



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