

Dec. 13, 1966

M. G. WANINGER

3,291,921

DEVICE FOR SUPPORTING AND FEEDING CABLES

Filed Sept. 3, 1963

4 Sheets-Sheet 1

Fig. 1

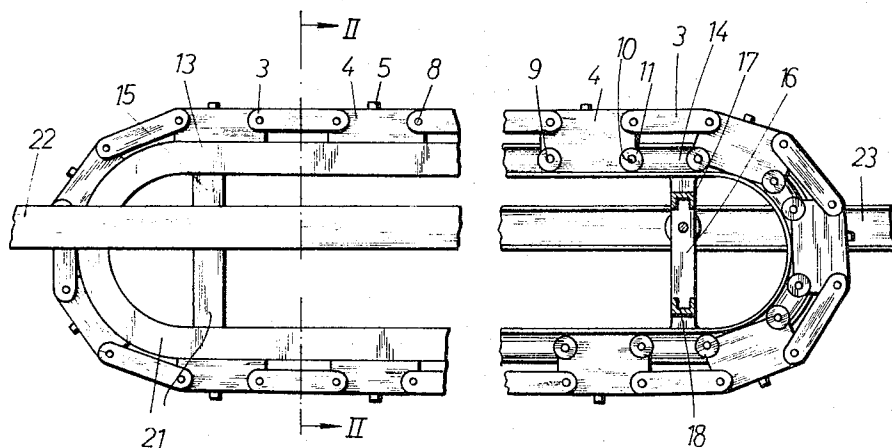
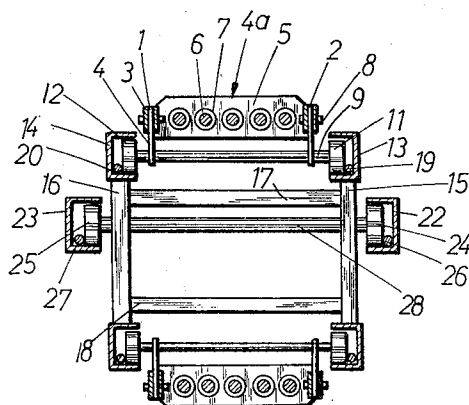


Fig. 2



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Fig. 3

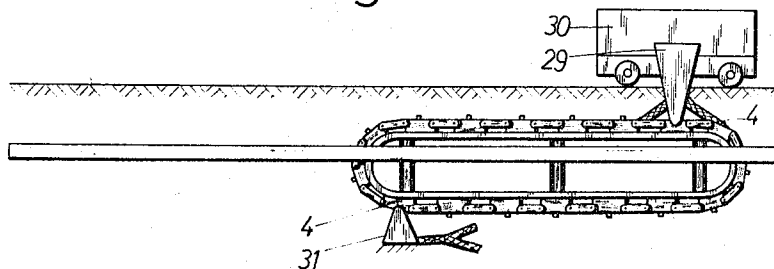


Fig. 4

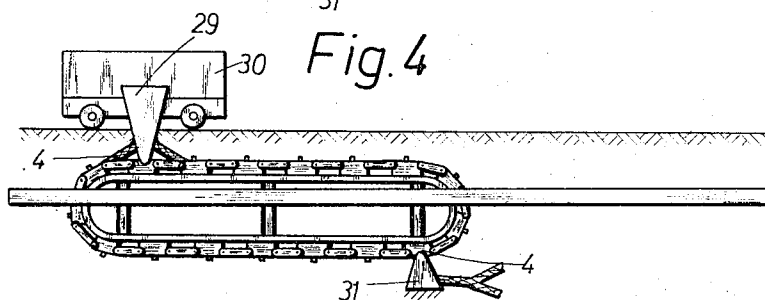


Fig. 5

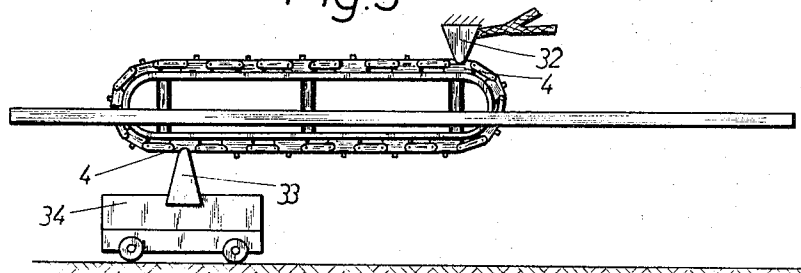
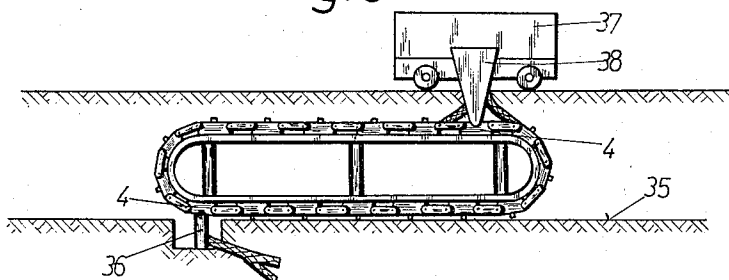


Fig. 6



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Fig. 7

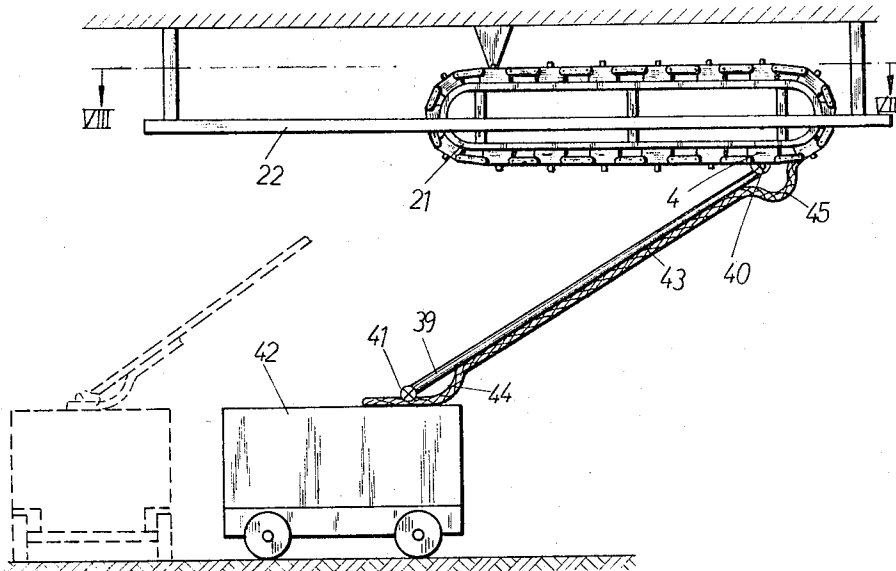
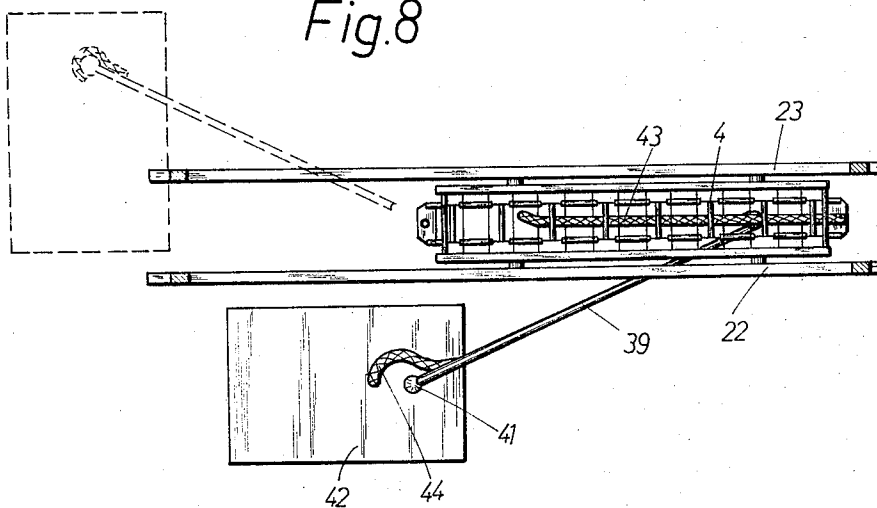


Fig. 8



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Fig. 9

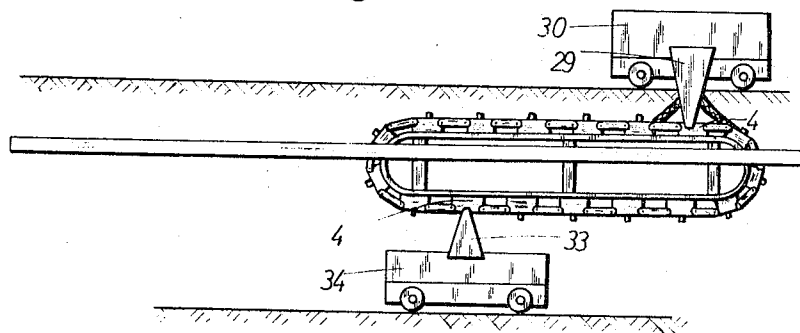


Fig. 10

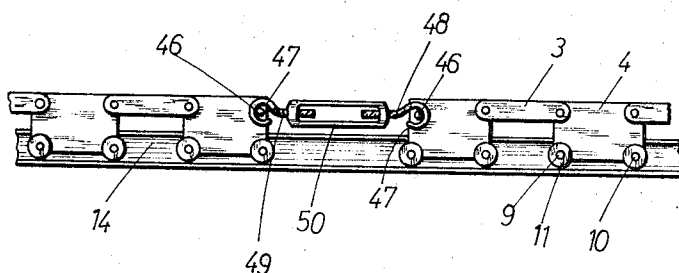
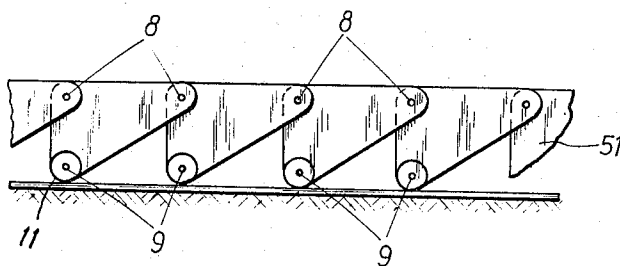


Fig. 11



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## DEVICE FOR SUPPORTING AND FEEDING CABLES

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Claims priority, application Germany, Sept. 4, 1962, K 47,666

10 Claims. (Cl. 191—12)

The present invention relates to an arrangement for guiding and supporting flexible long conduits and the like sensitive to pull, pressure, friction or undue bending. More specifically, a device of the above-mentioned type as involved in the present case comprises chains with supporting rollers on the chain links and with a stationary connection and a movable connection.

It is an object of the present invention to provide a chain arrangement for supporting and conducting energy carriers, which is easily movable and, being equipped with an upper and lower connection adapted to be connected to a consumer, can be employed universally.

It is a further object of this invention to provide an arrangement as set forth in the preceding paragraph which will make it possible for the consumer connected to the energy carrier on the chain arrangement of the invention to move in a plane and, to a limited extent, also in vertical direction while permitting a slight tilting movement.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIGURE 1 illustrates a side view of an arrangement according to the present invention in which the front supporting and front guiding rails have been omitted on the right-hand side of the drawings;

FIGURE 2 is a cross-section taken along the line II—II of FIGURE 1;

FIGURE 3 shows the arrangement according to the present invention in its right-hand end position (with regard to the drawing);

FIGURE 4 is a view similar to that of FIGURE 3 but showing the arrangement in its left-hand end position;

FIGURE 5 is an arrangement similar to that of FIGURES 3 and 4 but differing therefrom in that the connection adapted to be connected to the consumer is not located at the top thereof but at a bottom portion thereof, the arrangement in FIGURE 5 occupying its left-hand end position;

FIGURE 6 shows a further modification of the present invention having its connection to be connected to the consumer at the top and being supported by the lower chain section;

FIGURE 7 represents in side view still another modification of the invention with a lower connection for the consumer and a guiding linkage system;

FIGURE 8 is a section along the line VIII—VIII of FIGURE 7.

FIG. 9 is a diagrammatic side view representing a further embodiment of the invention showing two movable consumers.

FIG. 10 shows a finite chain having its ends interconnected by a turn-buckle.

FIG. 11 is a further modification of a chain for use in connection with the present invention.

The arrangement according to the present invention is characterized primarily in that the supporting rollers of the chains are guided in endless guiding rails closed in themselves, which are combined to a guiding frame.

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According to one embodiment of the present invention, the supporting rollers are arranged outside the link center of the chains. Selectively, the chains may be supported by the guiding frame and supporting rails or by the guiding frames and a supporting means on the upper or lower chain section. Depending on the way in which the chain is supported, the stationary connection and the movable connection for the consumer may be connected to the upper or to the lower chain section.

Preferably, when the connection to the consumer is arranged at the respective bottom portion of the chain, the chain is advantageously connected to the movable consumer by a guiding link system which, by means of spherical joints, is pivotally connected to the chain and also to the consumer. The chains may selectively be composed of supporting members which are spaced from each other and interconnected by a different type of link and which has journaled therein two shafts for the supporting rollers. Or, the chain may be composed of uniform links each of which supports one shaft only for the supporting rollers.

Referring now to the drawings in detail and FIGS. 1 and 2 thereof in particular, the arrangement shown therein comprises two endless chains 1 and 2 each of which is composed of alternate fish-plates 3 and supporting member 4. For reasons of symmetry, each two adjacent supporting members 4 are interconnected in a manner known per se in connection with chains, viz. by two fish-plates 3. The endless chains 1 and 2 are held together by webs 5. Webs 5 are connected to the supporting members 4 of the two chains 1 and 2 in such a way that at each supporting member 4 there is provided a web 5 with bores 6 for receiving the conduits 7, cables, flexible energy conductors, hoses, or the like, to be supported and guided. In addition to being connected by the webs 5, the two chains 1 and 2 are also interconnected by the shafts 9 and 10 carrying the rollers 11 and 12 and supported by the supporting members 4. As will be evident from FIG. 2, the said shafts protrude beyond the supporting members 4 and have the protruding portion supporting the rollers 11 and 12. The shafts 9 and 10 are identical and, for reasons of stability of the chain, preferably extend from one side to the other of the chain. For this reason, the shafts 9 and 10 are preferably arranged outside the center of the joints 8. The distance of the shafts 9 and 10 from the joints 8 is so selected that the passage of the cables 7 will not be interfered with. As stated above, the ends of shafts 9 and 10 carry the supporting rollers 11 and 12. Each supporting unit, generally designated 4a, comprises two spaced supporting members 4 interconnected by a web 5, shafts 9 and 10 carried by said supporting members 4, and supporting rollers 11 and 12 at the respective ends of said shafts 9 and 10. The supporting rollers 11 and 12 are guided in endless rails 13 and 14 of U-shaped cross-section. These rails are shaped so as to form an oval the straight sections of which correspond approximately to half the stroke of the consumer, for instance a machine to be supplied with energy, or the like. The curved ends of the oval structure are so dimensioned that their shortest diameter of curvature is larger than the smallest admissible radius of curvature of the guided cable 7, or the like.

The strength of the oval shape of the guiding rails 13 and 14 is increased by structural members 15 and 16 connected thereto in any convenient manner, for instance by welding. The thus reinforced guiding rails 13 and 14 are connected by transverse struts 17 and 18 to form a strong entity. The open sides of the cross-section of the guiding rails 13 and 14 face each other and are spaced

from each other by a distance corresponding to the distance between the supporting rollers 11 and 12.

Arranged in said guiding rails 13 and 14 for purposes of laterally guiding the energy conducting chain, there are provided track rails 19 and 20 which may, for instance, have a round profile. More specifically, these track rails are, depending on the purpose for which the energy guiding chain is used, mounted in the lower or upper corners of the cross-sectional U-profile of the rails 13 and 14. FIG. 2 shows the arrangement for a suspended energy guiding chain.

The guiding rails 13 and 14 are moved along by the chains 1 and 2 and, more specifically, at half the chain speed over half the chain stroke, as is known with cable or chain supporting carriages. The structure composed of guiding rails 13 and 14, structural members 15 and 16 and transverse struts 17 and 18 forms a guiding frame 21. The guiding frame 21 may be guided in conformity with the purpose for which it is used. To this end there are provided stationary supporting rails 22 and 23 supporting rollers 24 and 25. The track is also in this instance maintained by track rails 26 and 27. The rollers 24 and 25 are rotatably supported by the ends of the shafts 28 which are connected to the guiding frame 21.

An energy guiding chain designed in conformity with the above description does not require a support for the lower chain sections when rails 22 and 23 are employed. In this instance, selectively, the upper, the lower, or both chain sections may be moved, which means that the movable connection for the consumer may selectively be located at the top or at the bottom and, correspondingly, the stationary connection may be located at the bottom or at the top. Furthermore, according to another modification one movable connection may be arranged at the top or another movable connection may be arranged at the bottom (FIG. 9). In this way, two machines or machine parts may be interconnected by energy conductors while moving in the same or in opposite direction and while the machines may pass each other.

If an energy conducting chain according to the present invention is to be employed in customary arrangement, which means that the lower chain section rests on a support, it is merely necessary to omit the rails 22 and 23 with their track rails 26 and 27, and the rollers 24 and 25 with their shafts 28. With such an arrangement, of course, only an upper connection with the consumer will be possible.

FIGS. 3 to 8 illustrate embodiments for the above-mentioned possibilities. Thus, FIGS. 3 and 4 show an arrangement with movable upper connection for the consumer, FIG. 3 showing the outermost right-hand end position, and FIG. 4 showing the outermost left-hand end position. The follower 29 of the movable consumer 30 is, for instance, suspended on a supporting member 4 of the upper chain section, whereas the stationary connection 31 engages, for instance, a supporting member 4 of the lower chain section.

FIG. 5 illustrates an arrangement for a lower connection with the movable consumer. According to FIG. 5, the stationary connection 32 is arranged at the top and connected, for instance to a supporting member 4 of the upper chain section, whereas the follower 33 of the movable consumer 34 is linked to another supporting member 4 of the lower chain section.

With the arrangement of FIG. 6, the energy conductor carrying chain rests by means of its lower chain section on a supporting surface 35. In this instance, the stationary connection 36 is arranged in the manner in which it is found with energy conductor carrying chains of the type heretofore customary, whereas the follower 38 of the movable consumer 37 again engages the upper chain section.

Consumers which move in a predetermined horizontal plane in longitudinal as well as in transverse direction,

are supplied with energy by a chain, according to the present invention, which has a lower connection with the consumer and is provided with a guiding linkage 39, as shown in FIGS. 7 and 8. The guiding frame 21 of the energy conductor carrying chain is again guided by supporting rails 22 and 23. A guiding linkage 39 is linked to a supporting member 4 of the lower chain section by means of a spherical joint 40. The linkage 39 is connected to the movable consumer 42 through a further spherical joint 41. The cable or cables 43 are guided along the guiding linkage 39 and pass through a loop 44 into the consumer 42. If desired, the spherical joint 40 may also have adjacent thereto a loop 45 of the cable 43.

The guiding linkage 39 permits the consumer to move in a direction transverse to the direction of movement of the energy conductor carrying chain. The consumer 42 thus will be able to move over a predetermined surface. The spherical joints 40, 41 additionally permit a finite turning movement of the consumer 42, as indicated in dash lines in FIGS. 7 and 8. Also, a certain vertical movement and a tilting movement within certain limits in either direction will be possible for the consumer. Thus, the consumer 42 may, within certain limits, carry out three-dimensional movements.

The invention furthermore makes possible the following possibilities: instead of an endless chain 1 and 2, a chain with finite length may be employed which is closed through the intervention of a turn-buckle. The purpose of the turn-buckle consists in compensating for an overlapping of the chain pitch at the joint.

As has been described above, each chain joint 8 has associated therewith a shaft 9 or 10. Instead of a supporting member 4 receiving two shafts 9 and 10, and instead of fish-plates 3, selectively, uniform chain links may be employed throughout the chain as shown in FIG. 11. Of such uniform chain links, each one has one shaft 9 or 10 only with rollers 11. This shaft must be located below a joint 8. When short energy conductor supporting chains are employed, open finite chains may be used as long as the thrust occurring in the direction of movement does not affect the function of the chain. Such open finite chains are known per se and described for instance in German Auslegeschrift No. 1,065,050.

The supporting rails 22 and 23 for the guiding frame 21 may with a corresponding modification of the arrangement also be provided unilaterally with regard to the guiding frame 21. This embodiment is preferred when, for instance, two consumers which pass by each other are to be connected to energy conductors. Arrangements of this type are known and described for instance in *Dubbel, Taschenbuch für den Maschinenbau* (Handbook for Mechanical Engineers), vol. II, page 448, figs. 199 and 200.

It is, of course, to be understood that the present invention is, by no means, limited to the particular constructions shown in the drawings, but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. An arrangement for guiding and supporting flexible energy conveying conductors, especially cables and hoses, which includes: chain means having an upper chain section and a lower chain section and at least one arcuate chain section leading from said upper section to said lower section, said chain means comprising interlinked chain elements and supporting members carried by said chain elements for receiving and supporting energy conductors, stationary means connected to one of said upper and lower chain sections for guiding portions of energy conductors onto and guiding other portions of energy conductors from said chain means, movable means connected to the other of said upper and lower chain section for connecting energy conductors on said chain means

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with a movable consumer, supporting roller means supported by said chain means and distributed therealong, and guiding rail means movable relative to said stationary means for guiding said supporting by engaging said roller means and thereby guiding said chain means along a substantially oval path, said rail means comprising an upper portion which the upper chain section engages and a lower portion which the lower chain section engages and at least one arcuate portion leading from said upper portion to said lower portion and engaged by said arcuate chain section, each chain section being supported by its pertaining portion of said rail means.

2. An arrangement according to claim 1, which includes shaft means extending laterally of said chain means and carrying one of said roller means at each end and supported by said chain elements while being located outside the portion thereof occupied by said conductors.

3. An arrangement for guiding and supporting flexible energy conveying conductors, especially cables and hoses, which includes: endless chain means having an upper chain section and a lower chain section and arcuate end chain sections connecting the ends of the lower section with the ends of the upper section, said chain means comprising interlinked chain elements and supporting members carried by said chain elements for receiving and supporting energy conductors, stationary means connected to one of said upper and lower chain sections for guiding portions of energy conductors onto and guiding other portions of energy conductors from said chain means, movable means connected to the other of said upper and lower chain sections for connecting energy conductors on said chain means with a movable consumer, supporting roller means supported by said chain means, guiding rail means having upper and lower and arcuate end portions and forming a closed path, said rail means receiving said roller means and supporting said chain means along the entire length thereof, and elevated stationary support rails for movably supporting said guide rail means, said guide rail means including means movably engaging said stationary support rails.

4. An arrangement for guiding and supporting flexible energy conveying conductors, especially cables and hoses, which includes: endless chain means having an upper chain section and a lower chain section and arcuate end chain sections connecting the ends of the lower section with the ends of the upper section, said chain means comprising interlinked chain elements and supporting members carried by said chain elements for receiving and supporting energy conductors, the lower one of said chain sections being adapted for being disposed adjacent on stationary supporting surface, stationary means connected to said lower chain section for guiding portions of energy conductors onto and guiding other portions of energy conductors from said chain means, movable means connected to the upper chain section for connecting energy conductors on said chain means with a movable consumer, supporting roller means supported by said chain means in distributed relation therealong, and endless guiding rail means supported for movement relative to said stationary means and including means for supporting by and guiding by engaging said roller means so as to support all sections of said chain means, said guiding rail means guiding said chain means along a substantially oval path.

5. An arrangement for guiding and supporting flexible energy conveying conductors, especially cables and hoses, which includes: endless chain means having an upper chain section and a lower chain section below said upper chain section and arcuate end chain sections connecting the ends of the lower section with the ends of the upper section, said chain means comprising interlinked chain

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elements and supporting members receiving and supporting energy conductors, stationary means connected to one of said upper and lower chain sections for guiding portions of energy conductors onto and guiding other portions of energy conductors from said chain means, movable means connected to the other of said upper and lower chain sections for connecting energy conductors on said chain means with a movable consumer, said movable means including spherical joint means and link means connected to said spherical joint means for connection with a movable consumer, supporting roller means supported by said chain means in distributed relation therealong, and endless guiding rail means supported for movement relative to said stationary means and including means for guiding by and supporting by engaging said roller means so as to support all sections of said chain means, said guiding rail means guiding said chain means along a substantially oval path.

6. An arrangement according to claim 1, in which every second chain element when viewing in longitudinal direction of said chain means is provided with two shafts each carrying two supporting roller means and movable on said guiding rail means.

7. An arrangement according to claim 1, in which said chain means comprises uniform chain links throughout its length, and in which each of said chain links carries one pair of roller means only for rolling engagement with said guiding rail means.

8. An arrangement for guiding and supporting flexible energy conveying conductors, especially cables and hoses, which includes: endless chain means having an upper chain section and a lower chain section and arcuate end chain sections connecting the ends of the lower section with the ends of the upper section, said chain means comprising interlinked chain elements and supporting members carried by said chain elements for receiving and supporting energy conductors, first means connected to one of said upper and lower chain sections and leading portions of energy conductors onto said chain means, second means connected to the other of said upper and lower chain sections for connecting energy conductors on said supporting members with a movable consumer, supporting roller means supported by said chain means guiding rail means having upper and lower and arcuate end portions and forming a closed path, said rail means receiving said roller means and supporting said chain means along the entire length thereof, and elevated stationary support rails for movably supporting said guide rail means, said guide rail means including means movably engaging said stationary support rails, endless guiding rail means comprising two vertically spaced substantially straight sections interconnected by curved sections at the end and being movable relative to said first means, said guiding rail means supportingly receiving said roller means for guiding said roller means and thereby said chain means along a path corresponding to said guiding rail means.

9. An arrangement according to claim 8, in which both of said first and said second means are movable.

10. An arrangement according to claim 8, in which one of said first and second means is stationary and the other thereof is movable.

#### References Cited by the Examiner

##### UNITED STATES PATENTS

2,864,907	12/1958	Waninger	-----	191—12
3,008,015	11/1961	Mageoch et al.	-----	191—59.1
3,157,376	11/1964	Merker et al.		

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