

Oct. 25, 1966

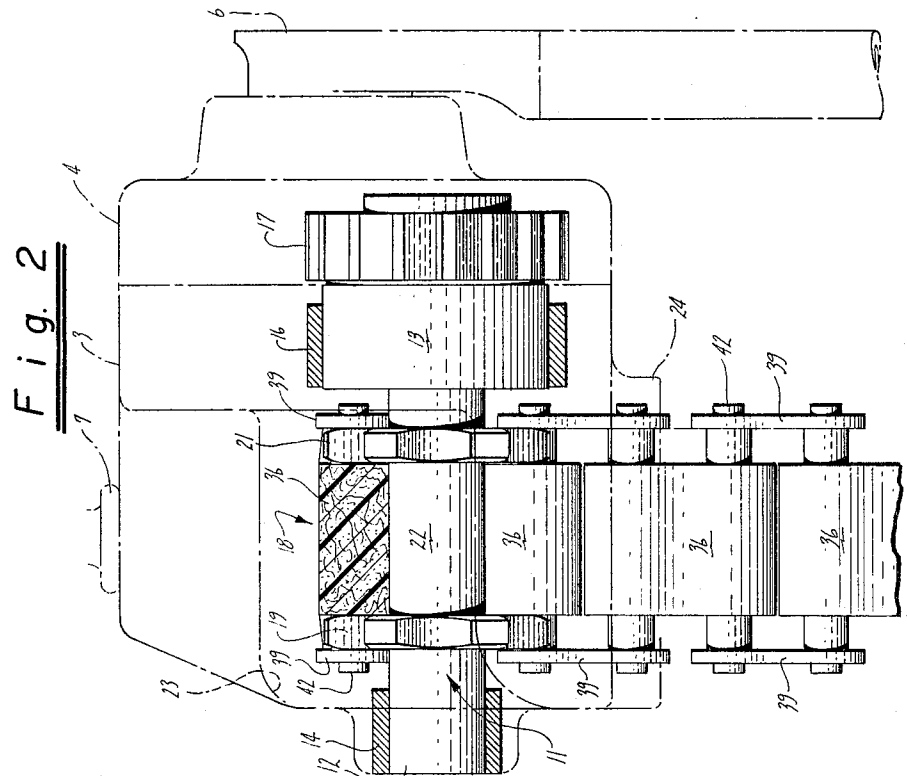
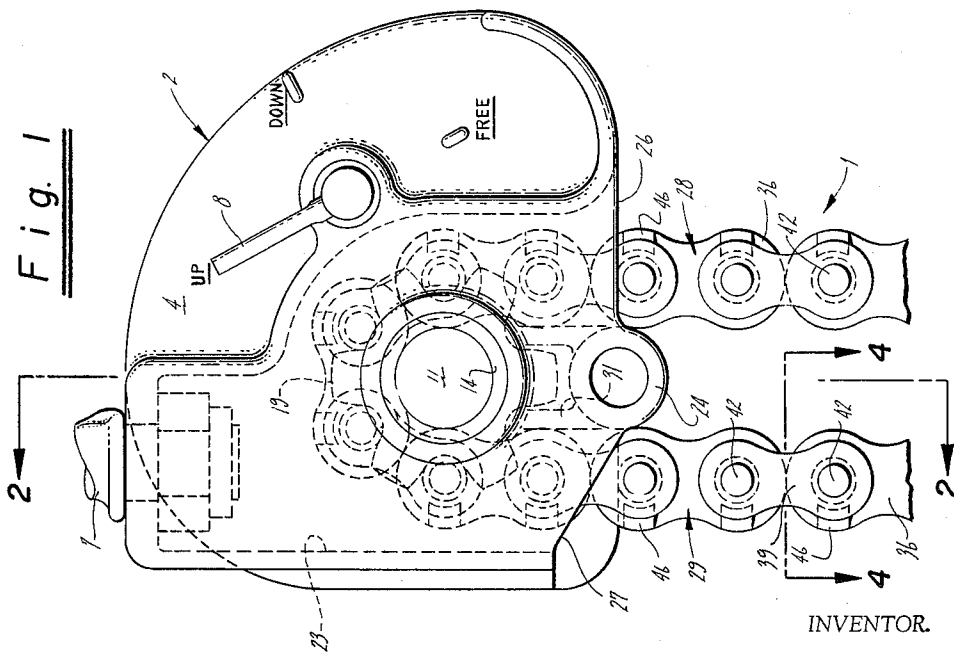
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3,281,121

DIELECTRIC CHAIN

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

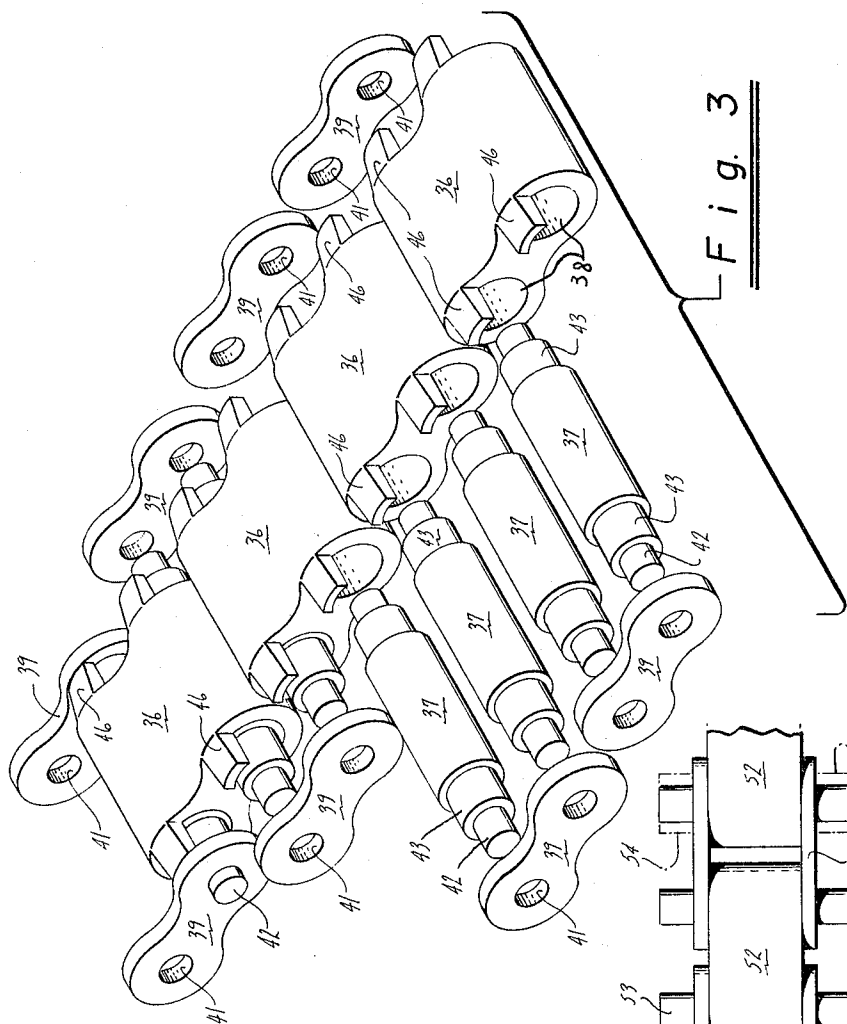


Fig. 3

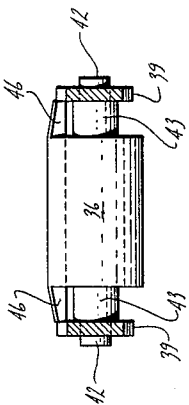


Fig. 4

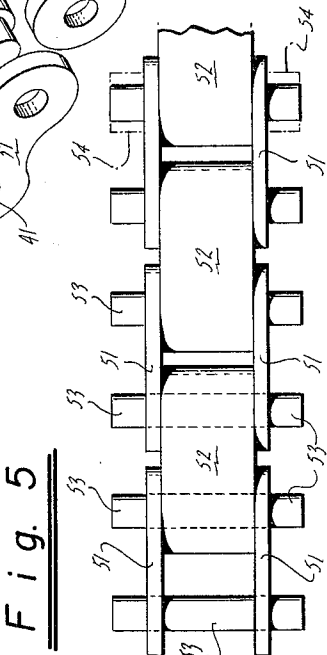


Fig. 5

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DIELECTRIC CHAIN

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8 Claims. (Cl. 254-167)

This invention relates generally to a load sustaining element of the flexible chain type. More particularly this invention relates to an electrical non-conductive dielectric chain. Still more particularly this invention relates to a dielectric chain particularly well adapted for use in combination with a rotatable sheave or sprocket wheel. In this regard, the subject dielectric chain is particularly well adapted for use in combination with mechanical lifting or hoisting tools, such as portable hand operated hoists of the type frequently employed by utility linemen while they are working adjacent high voltage lines or other source of electricity.

While it should be apparent that the dielectric chain of this invention is not limited to use in conjunction with hoists and like tools, it is illustrated and described herein when so employed because of the dangerous problem encountered by utility linemen working in proximity to high voltage sources. Thus, use of such a dielectric chain in a hoist or like tool safeguards and isolates a lineman employing the tool from the damaging effects of electricity should the chain come in contact with or be placed in close proximity to an electrical source during use of the tool.

Because the chain of this invention is well adapted for use in conjunction with a lifting tool such as a hoist, it not only must have the requisite non-conducting properties to make the same effective from a safety standpoint, but it also must possess the requisite strength characteristics so that the same may be employed to support and sustain substantial loads placed thereon.

Furthermore, as will be described hereinafter, while the dielectric chain of this invention is well adapted for use in conjunction with a pawl and ratchet type hoist, its effectiveness in other types of hoisting tools, such as friction brake hoists and gear hoists, also should be obvious. In this connection, the subject chain is particularly well suited for use in conjunction with a hoist of the type illustrated and described in my Patent No. 2,967,046 dated January 3, 1961, and reference is directed to that patent for details of the hoist operating mechanism which regulates rotation of the sheave or sprocket wheel about which the subject chain passes when employed in such a tool. Hereinafter, specific details of such operating mechanism and control structure have been omitted because such features form no part of this particular invention and reference is directed thereto only to illustrate one environment in which the subject chain is useable.

From the foregoing it should be understood that objects of this invention include the provision of a non-conducting load sustaining element; the provision of a flexible dielectric chain adapted to pass over a sheave or sprocket wheel; the provision of a non-conducting chain formed from alternate links of dielectric material integrally connected with each other; the provision of a dielectric chain useable in conjunction with a rotatable sheave in a hoist or like lifting tool; and the provision of a dielectric chain particularly well suited for use in conjunction with a sheave having spaced chain engaging tooth portions thereon.

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These and other objects of this invention will become evident from a study of the following description in which reference is directed to the accompanying drawings.

In the drawings:

5 FIG. 1 is a side elevational view of the subject chain showing passing through a hoist casing.

FIG. 2 is a vertical sectional view taken in the plane of line 2-2 of FIG. 1 with the hoist casing being shown in phantom lines for purposes of clarity of illustration.

10 FIG. 3 is an exploded view of the subject dielectric chain illustrating details of construction thereof.

FIG. 4 is a sectional view through the subject chain taken in the plane of line 4-4 of FIG. 1.

15 FIG. 5 is a plan view of a modified chain construction.

The chain embodiments illustrated in the drawings are of the type specifically designed to pass over and be engaged by a rotatable double or split sheave or sprocket wheel which has laterally spaced chain engaging tooth portions thereon separated from each other by a generally cylindrical intermediate shaft portion. Such a sheave is shown in FIGS. 1 and 2 rotatably mounted in the casing of a hoist construction of the type disclosed in aforementioned Patent No. 2,967,046. The principal difference between the construction illustrated in such patent and 25 in FIGS. 1 and 2 of the drawings herein resides in the fact that the sheave shown herein is of the double or split type as described above, whereas in the patent a more conventional single sheave is employed.

For details of an illustrative operating mechanism and control structure which may be employed to regulate selective rotation of the sheave shaft with which the subject chain is engaged, reference is directed to the disclosure of the aforementioned patent.

For purposes of this invention, it is believed necessary 35 only to point out that the subject dielectric chain, generally designated 1, when employed in a hoist passes through a hoist casing generally designated 2. In the illustrated embodiment, casing 2 is comprised of two sections 3 and 4 which are separable from each other in the manner disclosed in said patent. An operating handle structure 6 is operatively interengaged with one of the casing sections 4 as seen in FIG. 2 and as described in said patent. A load sustaining hook 7 is operatively connected with the other casing section 3 and projects upwardly therefrom for the well known purpose.

Also, as seen in FIG. 1, a control lever 8, which is operatively connected with the control structure of the hoist in the manner described in said patent, also is pivotally mounted on the hoist casing section 3. The 50 purpose of this control lever 8 is to regulate functioning of the control structure so that up, down, and free chain conditions may be readily obtained in the manner described in said patent.

Rotatably mounted in the hoist casing is a sheave 55 shaft 11 having opposite end portions 12 and 13 thereof positioned in bearing members 14 and 16 mounted in the casing section 3 as shown in FIG. 2 and as illustrated in greater detail in said patent. Thus, shaft 11 is mounted for rotation in either direction in the hoist casing.

60 Adjacent the larger shaft bearing section 13 on shaft 11 is ratchet wheel 17 which cooperates with the operating mechanism of the hoist in selectively controlling rotation of the shaft and the sheave thereon in the manner described in said patent. This ratchet wheel comprises 65 means to prevent rotation of the shaft when the ratchet

teeth thereon are engaged with pawl members provided therefor as described in said patent. Thus, rotation of shaft 11 may be permitted or precluded selectively, depending upon the condition of interengagement of the ratchet wheel 17 with the pawls of an associated operating mechanism.

Intermediate the shaft bearing sections 12 and 13 is provided the chain engaging sheave, generally designated 18. In the illustrated embodiment this sheave comprises two laterally spaced toothed portions 19 and 21 between which a generally cylindrical shaft portion 22 extends. The toothed portions 19 and 21 project circumferentially from the shaft and are spaced from each other a distance determined by the dimensions of the dielectric chain to be engaged therewith. In this regard, the sheave, when the shaft 11 is properly positioned in its associated hoist casing, is received in a hollow portion 23 of the casing section 3 of the hoist so that the chain 1 may pass in either direction through the casing upon rotation of the sheave shaft.

An apertured boss 24 depends from casing section 3 of the illustrated hoist and separates the sheave receiving portion 23 thereof into two passages 26 and 27 through which the opposite reaches 28 and 29 of the chain pass. This apertured boss has an upwardly projecting split extension 31 which projects into close proximity to the intermediate shaft portion 22 lying between the toothed portions 19 and 21 of the sheave shaft. This central portion 31 serves as a chain stripper for the well known purpose. In this connection, it should be noted that the split chain stripper 31 is formed in generally U-shape, as seen in FIG. 1, so that the teeth of the sheave sections may be slid laterally between the spaced portions of the stripper during insertion or removal of the sheave shaft from the hoist casing.

The purpose of the apertured boss additionally is to permit an end of the chain to be connected to the hoist casing in the well known manner so that the hoist may be used in a block and tackle type assembly when so desired.

Having thus made a general disclosure of the type of environment in which the subject chain is well adapted for use, details of the dielectric construction itself will now be given.

Referring to FIG. 3, one embodiment of the subject chain construction comprises a series of electrically non-conducting dielectric links 36 pivotally interconnected with each other by connecting links. The connecting links illustrated comprise a series of pins 37 which extend transversely through cylindrical bores 38 provided in spaced relationship in the respective dielectric links 36. Each link 36 is provided with a pair of such spaced bores so that the pins of adjacent connecting links are receivable therethrough as shown.

Secured to opposite end portions of the adjacent connecting pins 37 which extend through adjacent dielectric links 36 are connecting side plates 39 having spaced bores 41 therethrough to receive therein end portions 42 of the respective connecting pins. The ends 42 of the pins may be peened over or otherwise secured to maintain engagement between the pins and the side plates.

Thus, as seen in FIGS. 1 and 2, each adjacent pair of dielectric links 36 are pivotally interconnected with each other by a connecting link structure defined by two pins and two side plates.

In the chain embodiment shown in FIGS. 1 through 4, sheave engaging shoulder portions 43 are provided on the respective connecting pins 37 which are of greater diameter than the pin ends 42. These shoulder portions, however, are of less diameter than the central portions of the pins which are engaged within the bores 38 of the dielectric links. It is these shoulder portions 43 which form pin bearing sections which are to be engaged with the toothed portions of the chain sheave in the manner shown

in FIGS. 1 and 2. Thus, the teeth of the spaced portions of the sheave are received inwardly of the side plates 39 of the connecting links between such side plates and the dielectric links as shown in FIG. 2.

Each of the dielectric links preferably is provided with means to maintain the dielectric links properly positioned centrally of the pins 37 to maintain the necessary spaces between the connecting side plates and the dielectric links so that the sheave teeth may be accommodated therebetween. In the embodiment illustrated, such means comprises laterally extending projections 46 formed integral with the dielectric links which generally engage the inner surfaces of the associated side plates 39. These lateral projections are provided generally in line with the respective bores 38 through the dielectric links at opposite ends of such bores but project only a short distance circumferentially of such bores so that they will not interfere in any way with engagement of the chain with the sprocket teeth, as best seen in FIG. 1.

In the chain embodiment of FIGS. 1 through 4, the connecting pins and side plates preferably are formed from metal, such as a suitable steel, because of the strength of such material in components of small size. However, it should be understood that dielectric material also could be employed for the pins and side plates if preferred but in such instance substantially larger dimensions for dielectric components would be required to obtain the same strength characteristics of metal components.

Thus, it is preferred to use alternate dielectric and metal links as illustrated because such a construction results in a relatively narrow yet high strength chain which is positionable in compact hoist housings of the type shown in FIGS. 1 and 2 or in comparable applications where size is an important factor. Because the alternate dielectric links of the chain effectively insulate and separate the metal connecting links from each other, the requisite non-conducting characteristics desired are fully obtained.

Referring to FIG. 5, a modified construction of the subject dielectric chain is illustrated. Side connecting plates 51 in this modified arrangement are positionable directly in contact with the alternate dielectric links 52. In this regard, single diameter connecting pins are employed which have end portions 53 thereof projecting laterally beyond the side plates. In this modified engagement, the spaced tooth sections of a split sheave are to be engaged externally or on the outer sides of the respective connecting side plates, rather than between the side plates and the dielectric links as in the previously described embodiment.

A further distinction of the FIG. 5 embodiment resides in the elimination of the lateral spacer projections 46 described previously so that the side plates 51 may be positioned generally in direct contact with the side surfaces of the dielectric links as shown.

The side plates 51 may be maintained in position on their associated connecting pins in any suitable fashion, such as by crimping or otherwise deforming the pins. Alternatively, as seen in phantom lines in FIG. 5, if preferred small collars 54 may be pressed fitted or otherwise secured to the outer ends 53 of each pin to preclude separation of the pins and side plates. If this latter alternative is employed, the teeth of the sheave will be engaged with the outer peripheries of the collars, rather than directly with the pin ends.

While various electrically non-conducting materials may be employed for the alternate links of the subject chain, it is preferred that a non-metallic material having suitable strength be employed in the subject chain for the alternate dielectric links. In this regard, a material well suited for this purpose is a resinous dielectric thermoplastic of the reinforced type disclosed in Patent No. 2,877,501. Such a glass fiber reinforced plastic is marketed by Fiberfil, Inc. of Warsaw, Indiana, under the name "Nylafil" as described in its descriptive properties literature dated April 30, 1962. Another plastic which may

be employed is marketed under the name "Delrin" by the Du Pont Company of Wilmington, Delaware. The description and physical properties of Delrin are described in detail in the 2nd edition of Du Pont brochure A-22852-15M copyrighted in 1961.

The exact type of dielectric material chosen may vary with the above materials being described by way of illustration. It is important, however, that the material from which the alternate dielectric links of this chain are formed have adequate insulating properties and sufficient strength to withstand and sustain the electrical charges and physical loads to which such a chain will be subjected when employed in the environments disclosed herein. In this regard, by way of example, a dielectric chain of this invention should have mechanical strength which closely approximates or equals the strength of a metal chain of substantially the same size.

While one piece continuous dielectric tapes or cables are available, such products do not have the requisite flexibility required to be employed in a hoist or like lifting tool of compact construction. Such continuous dielectric tapes can only be used with very large size diameter sprocket wheels which make their use in a hoist of the hand operated type illustrated herein impractical or impossible. That is, a continuous dielectric tape having the strength equivalent to a metal chain are of such large size that they cannot be employed with small diameter sprockets of the type receivable in a small hoist casing. Smaller tapes having the requisite flexibility do not have sufficient strength for the purpose described.

The illustrated dielectric chain is highly effective in that the dielectric links are maintained generally out of contact with the teeth of the split sheave as shown in the drawings. Therefore compression forces are not applied to the dielectric links in the chain by the split sheave construction shown. Thus, the dielectric links are subjected only to tension forces which they are fully capable of sustaining when the links are formed from strong dielectric material of the type described above.

While a rollerless type chain has been illustrated, it should be understood that this invention is equally applicable for use in conjunction with a roller type chain.

Having thus made a full disclosure of this invention, reference is directed to the appended claims for a determination of the scope to be afforded thereto.

What is claimed is:

1. A dielectric chain for use in conjunction with sheaves in hoists and other load sustaining devices, comprising a series of alternate generally spaced links of non-conducting and essentially non-stretchable dielectric material, and means interposed between and pivotally interconnecting each adjacent pair of dielectric links with each other in a flexible non-conducting and essentially non-stretchable chain assembly which is adapted to pass over a sheave which is contoured in accordance with the contour of said dielectric links; said means comprising a series of pins extending transversely through adjacent dielectric links, and a series of side plates secured to and extending between alternate pairs of adjacent pins whereby adjacent dielectric links are pivotally interconnected with each other and maintained generally spaced from each other by said pins and side plates.

2. A non-conducting and essentially non-stretchable dielectric chain adapted to be passed over and engaged with a sheave in a hoist or other load sustaining device, comprising alternate spaced links of non-conducting and essentially non-stretchable non-metallic dielectric material, each of said dielectric links having a pair of spaced bores extending transversely therethrough; and alternate connecting links interposed between, pivotally interconnecting, and maintaining spaced apart each pair of said dielectric links; each of said connecting links comprising a pair of metal connecting pins extending through adjacent bores of adjacent dielectric links and beyond the side surfaces thereof, and metal side plates extending between

and secured adjacent the ends of such pair of pins; said side plates and pins interconnecting said dielectric links into a strong non-conducting load supporting chain which is capable of passing back upon itself around a small diameter sheave in such hoist.

3. The chain of claim 2 in which said dielectric links are formed from a resinous plastic material impregnated with non-conducting means to reinforce and strengthen the same.

4. A dielectric chain adapted to be passed over and engaged with a sheave having laterally spaced toothed portions thereon, comprising a series of alternate generally spaced apertured dielectric links each of which has a pair of spaced bores extending transversely therethrough, and a series of connecting links alternately interposed between adjacent pairs of said dielectric links, said connecting links comprising connecting pins extending through the bores of said dielectric links and beyond the sides thereof, and connecting plates secured to and extending between adjacent pins of adjacent dielectric links of said chain whereby said adjacent links are pivotally interconnected, said pins having end bearing sections thereon at opposite sides of said dielectric links which are engageable with the laterally spaced toothed portions of said sheave when said chain and sheave are engaged so that said dielectric links lie between said toothed portions of said sheave as said chain passes thereover, said plates of said alternate connecting links being secured on said pins in laterally spaced relationship relative to the sides of said dielectric links so that said bearing sections are provided inwardly of said plates so that said toothed portions are receivable between said plates and said links.

5. The chain of claim 4 in which each of said dielectric links includes a plurality of integral projections extending laterally therefrom to maintain each of said dielectric links spaced from its associated connecting plates.

6. In combination in a hoist or like load sustaining device, a rotatable sheave and a non-conducting essentially non-stretchable load supporting dielectric chain passing over said sheave; said chain comprising a series of alternate generally spaced links of non-conducting essentially non-stretchable dielectric material, and means pivotally interconnecting each adjacent pair of dielectric links with each other; said means comprising a connecting link interposed between each such adjacent pair of dielectric links, each said connecting link comprising connecting pins extending transversely through such adjacent dielectric links, and side connecting plates secured to and extending between adjacent connecting pins whereby the links of each said pair of adjacent dielectric links are pivotally interconnected with each other in spaced relationship relative to each other.

7. The combination of claim 6 in which each of said dielectric links is formed from a resinous plastic material impregnated with non-conducting means to further reinforce and strengthen the same.

8. In combination, a rotatable chain sheave having a pair of laterally spaced toothed portions separated by a shaft portion, and a dielectric non-conducting and essentially non-stretchable chain engaged with and passing over said sheave, said chain comprising a series of alternate generally spaced apertured links of essentially non-stretchable dielectric material each of which has a pair of spaced bores extending transversely therethrough, and a series of connecting links alternately interposed between adjacent pairs of said dielectric links; said connecting links comprising connecting pins extending through the bores of said dielectric links and beyond the sides thereof, and connecting plates secured to and extending between adjacent pins passing through adjacent dielectric links whereby each adjacent pair of dielectric links is pivotally interconnected; said pins of said connecting links having end bearing sections thereof which lie on opposite sides of said dielectric links engaged with the lateral-

ly spaced toothed portions of said sheave so that said dielectric links lie between said toothed portions of said sheave as said chain passes thereof, said chain and said sheave being dimensioned relative to each other so that only said connecting links are engaged with said sheave toothed portions as said chain passes over said sheave. 5

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