United States Patent [19]

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[11] **3,721,260**

[45] **March 20, 1973**

[54] **PLEATED EXTENSIBLE CARRIAGE FOR CONVEYING FLOWABLE ENERGY THEREALONG**

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[22] Filed: **Dec. 16, 1971**

[21] Appl. No.: **208,559**

[52] **U.S. Cl.**.....**137/355.16,** 137/615

[51] **Int. Cl.** **B65h 75/36**

[58] **Field of Search** 137/355/16, 355.17, 355.18, 137/355.20, 355.22, 355.28, 615; 141/279, 388, 387, 386

[56] **References Cited**

UNITED STATES PATENTS

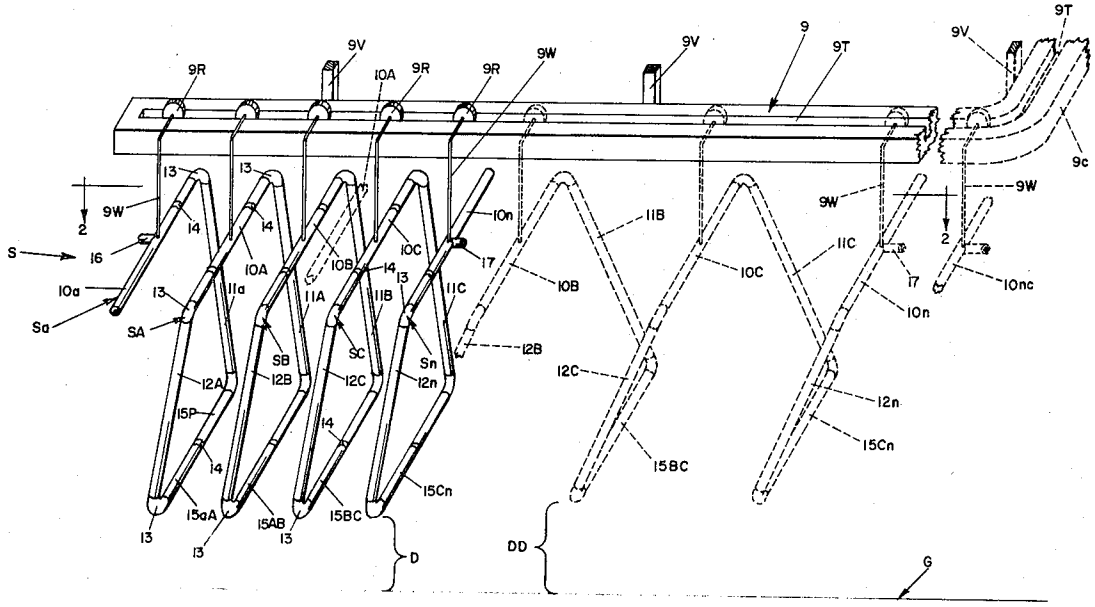
2,715,912	8/1955	Cameron et al.	137/615 X
2,720,217	10/1955	Vossbrinck	137/615 X
2,935,080	5/1960	Klimek	137/355.16 X
2,948,306	8/1960	Kuraeff	137/615 UX
3,050,092	8/1962	Pakanis et al.	137/615 X
3,059,664	10/1962	Schweitzer et al.	137/615 X
3,281,080	10/1966	Hogg	137/615 UX
3,399,909	9/1968	Ambrose	137/615 X
3,610,058	10/1971	Mueller et al.	137/355.16 X

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[57] **ABSTRACT**

There is described herein a pleated carriage longitudinally extensible along and guidable by a tracking means and adapted to convey in conduit and other pleated paths therealong flowable energy sources to reciprocating machines. The longitudinally extensible pleated carriage comprises for consecutive carriage pleats a transversely extending shoulder member together with a pair of transversely separated elongate upright legs that have a longitudinally spreadable relationship with respect to each other and to the shoulder, consecutive pleats remote of the shoulder and at opposite legs being connected with a transversely extending bridge member; when flexible conduits are employed, there are means to protect them from pinching, kinking, or undue strain as the carriage is longitudinally extended and retracted.

12 Claims, 8 Drawing Figures



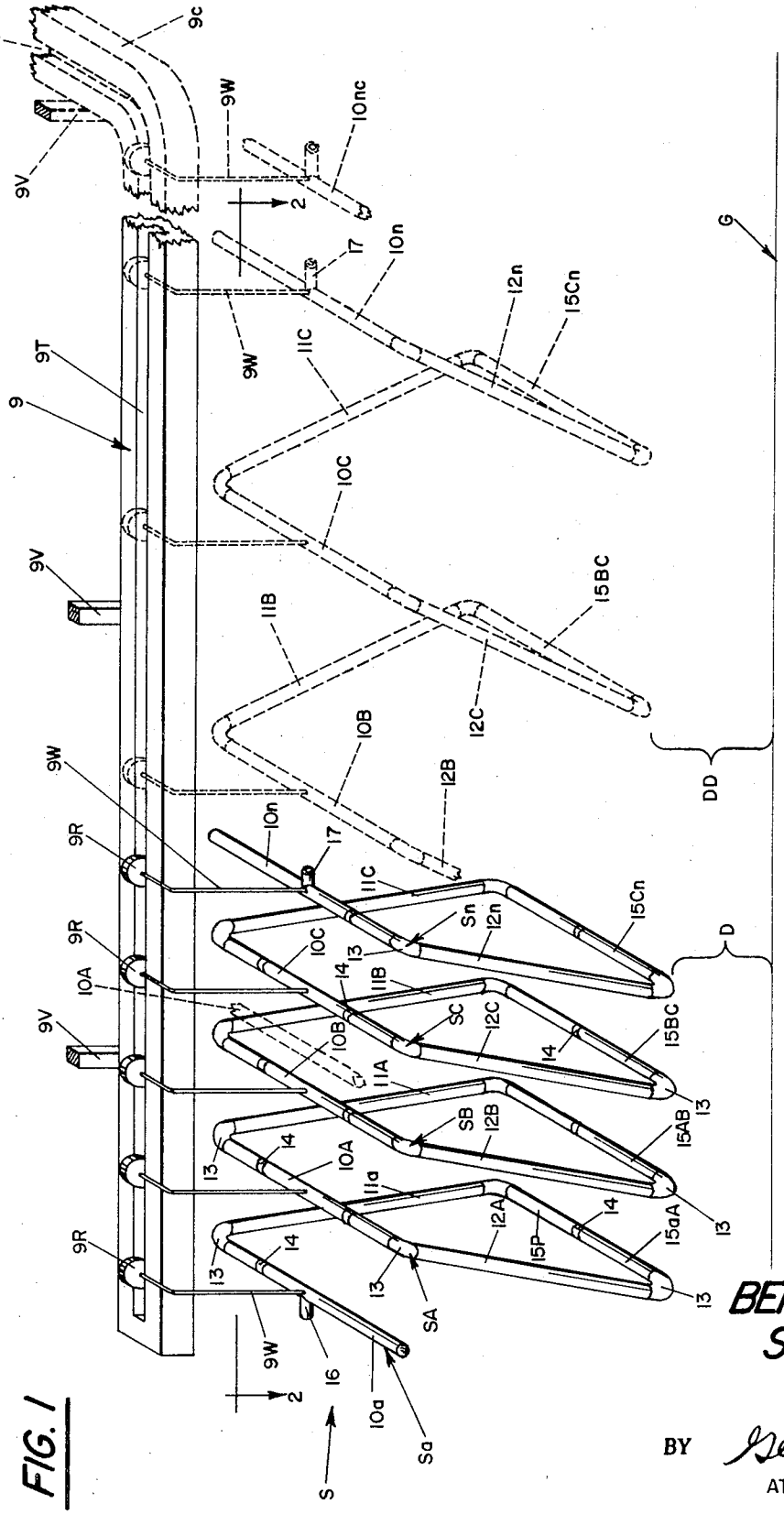


FIG. 1

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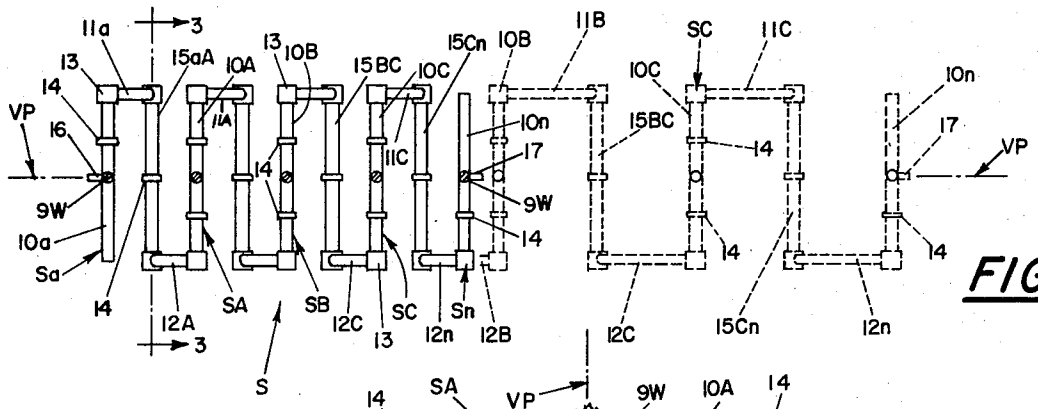


FIG. 2

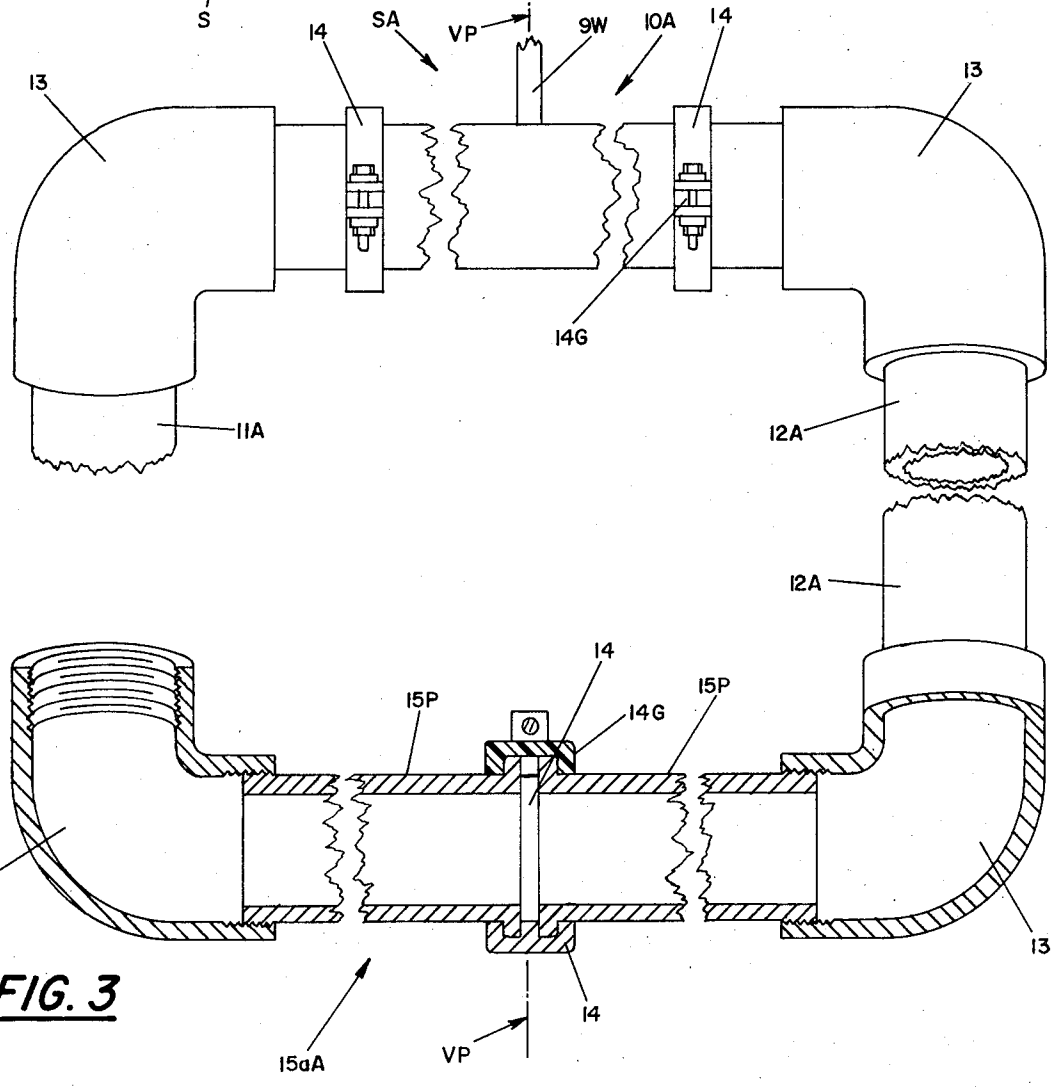


FIG. 3

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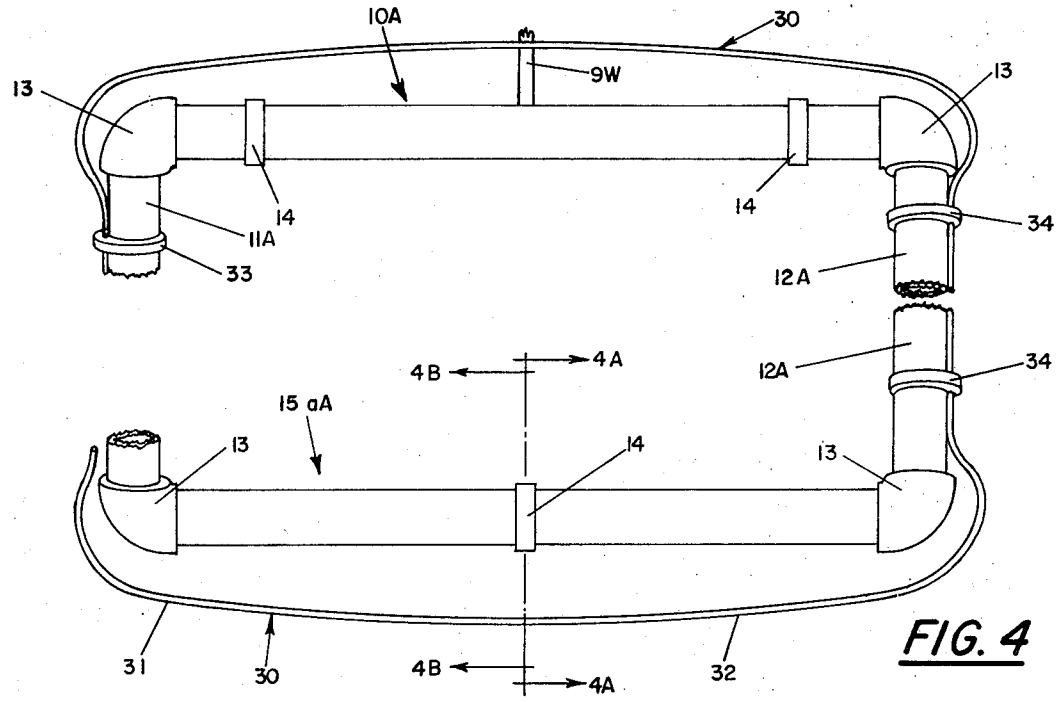


FIG. 4

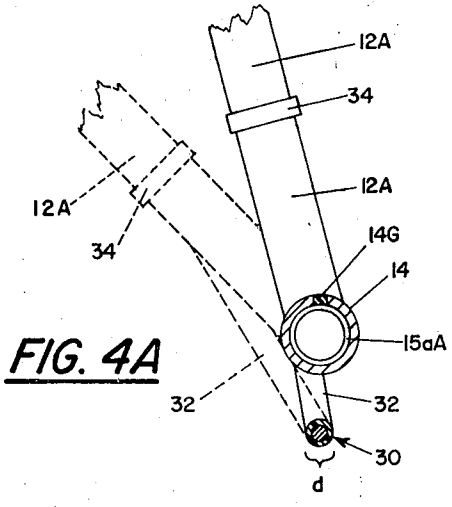


FIG. 4A

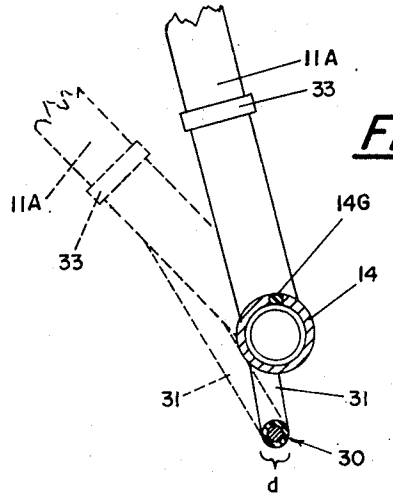


FIG. 4B

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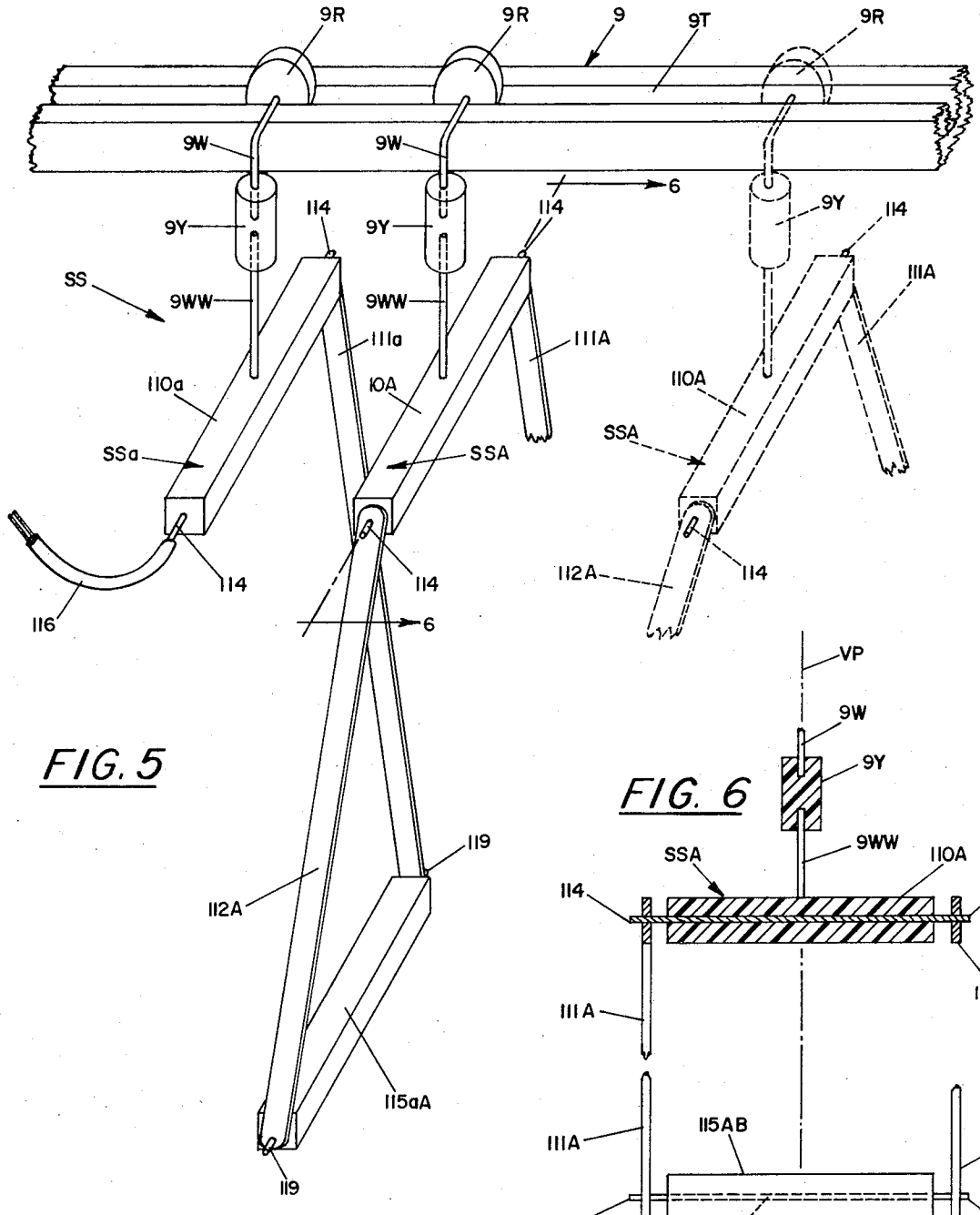


FIG. 5

FIG. 6

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PLEATED EXTENSIBLE CARRIAGE FOR CONVEYING FLOWABLE ENERGY THEREALONG

For factory installations and at construction sites it is oftentimes necessary to supply longitudinally extensible and retractable paths of power lines and other energy e.g. steam, compressed air, hydraulic fluid, electrical conductors, etc., for feeding motive energy to longitudinally horizontally reciprocatable machines. For example, such horizontally movable machines might typically include lathes, machine tools of various kinds, trolleys, hoists, cranes, and materials handling systems. A satisfactory carrier system is required for the energy lines, and if the longitudinally extensible and retractable energy line comprise flexible conduits, the carrier must have a sturdy frame or housing to protect the conduits from being pinched, kinked, or otherwise physically strained.

The prior art has endeavored to provide suitable carrier systems in a variety of ways, all of which possess disadvantages of one sort or another. For supplying electrical power lines exclusively, carriers supplied as reels and cooperating with brushes are well known. In the case of such electrical cable reels, however, the reel housing is necessarily relatively bulky and large. To ensure reliable operation, sliding contacts need to be maintained in good working order at all times, and the reel housing must be guarded against fouling. In an effort to do away with brushes, and to accommodate non-electrical cables, the prior art has employed undulate conduits, such as vertical festoons and horizontally looped belts. However, these undulate type energy carrier systems require heavy and bulky housing means to prevent kinking, pinching, and other inimical strain upon the conduits. Moreover, prior art undulate carrier systems have oftentimes proved to be unduly expensive, complicated, bulky and inefficient.

It is accordingly the general object of the present invention to provide a carrier system for supplying longitudinally extensible and retractable energy lines to longitudinally reciprocatable machines that has a reliable and simple longitudinally reciprocatable frame for the energy lines therealong.

It is another object to provide a carrier system for supplying conduits and other paths of flowable energy and within the general class of undulate carriers, the carrier system being well adapted to protect the longitudinally extensible energy lines from kinking, pinching, fouling, or other objectionable external effects.

It is another object to provide an energy carrier system that is exceedingly compact and unusually light in weight per unit length so that the pleated energy lines supporting framework requires a minimum of space and auxiliary supporting mechanisms.

It is a further object to provide a carrier system that is adaptable to many sorts of power lines, for many sorts of tracking means, that is economical to manufacture, reliable and simple in operation, and that requires a minimum of maintenance.

With the above and other objects and advantages in view, which will become more apparent as this description proceeds, the pleated extensible carriage structure for conveying flowable energy in a pleated path therealong comprises in consecutive pleats a pair of

relatively longitudinally spreadable elongate legs extending uprightly from transversely separated locations of a common shoulder member, neighboring pleats being joined together at opposite legs remote from the shoulders with a transversely extending bridge; for energy conduits, at least one pleated conduit is supported by and extends along the pleated carriage, and transversely extending portions of flexible conduits are unrestrained with respect to immediately proximal carriage portions.

In the drawing, wherein like characters refer to like parts in the several views, and in which:

FIG. 1 is a perspective view of a representative embodiment of the pleated extensible carriage of the present invention.

FIG. 2 is a sectional plan view taken along line 2—2 of FIG. 1.

FIG. 3 is a sectional elevational view taken along line 3—3 of FIG. 2.

FIG. 4 is a sectional elevational view similar to FIG. 3 but with a flexible pleated conduit additionally employed therewith.

FIGS. 4A and 4B are sectional elevational views taken in opposite directions along line 4A—4A and 4B—4B of FIG. 4.

FIG. 5 is a perspective view, similar to FIG. 1, of another embodiment of the pleated extensible carriage concept of the present invention.

FIG. 6 is a sectional elevational view, similar to FIG. 3, taken along line 6—6 of FIG. 5.

Turning initially to FIGS. 1-3 which disclose a typical embodiment "S" of the pleated extensible carriage concept of the present invention. Carriage embodiment "S" has an arbitrarily selected number of three similarly constructed full pleats "SA", "SB", and "SC"; moreover, there are the two terminal half-pleats "S*a*"and "S*n*". However, it is to be understood for this and other embodiments of the pleated extensible carriage concept that any reasonable number of full pleats greater than two or three might be selected and employed, without departing from the spirit of the invention. There is some type of longitudinally extending tracking means for guidably supporting the pleated carriage, and the carriage is longitudinally guidably extensible lengthwise along the tracking means. The tracking means of FIGS. 1–3 takes the form of an overhead rail 9 (supported by 9V) with the pleated carriage "S" suspended therefrom; however, it is to be understood that the elongate tracking means might take a variety of specific form and might even be so low in elevation as to be wholly below the carriage. Each of the carriage pleats comprises two elongate upright legs 11 and 12 emanating from a common shoulder member 10 and having a longitudinally spreadable relationship with respect to each other and to their common shoulder member. For example, full pleat "SA" has shoulder 10A, first-leg 11A, and second-leg 12A; the next pleat "SB" has shoulder 10B, first-leg 11B, and second-leg 12B; and the third pleat "SC" has shoulder 10C, first-leg 11C, and second-leg 12C. The two terminal or half-pleats "S*a*" and "S*n*" respectively comprise a shoulder 10*a* and a first-leg 11*a*, and a shoulder 10*n* and a second-leg 12*n*. Opposite legs 11 and 12 of consecutively positioned neighboring pleats remote of shoulder members 10 are connected with an inter-pleats bridge,

such as **15**. Thus, by virtue of the longitudinally spreadable relationship for intra-pleat legs **11** and **12**, carriage "S" commencing from some selected relatively longitudinally collapsed compact-station (as indicated by solid lines in FIGS. **1** and **2**) can be longitudinally extended therefrom (phantom lines in FIGS. **1** and **2**). Of course, the carriage can be longitudinally retracted from the extended phantom line conditions.

In the normal operating situation, the pleated extensible carriage structure "S", "SS",etc., is stored in readily longitudinally extensible condition at a selected compact-station therefor located along a short (and preferably linear) longitudinally extending finite-length of the tracking means. Such linearly and longitudinally extending track rail **9** and its grooved portion **9T**, indicated in solid line in FIGS. **1** and **5**, will serve as a convenient directional reference for the various components of the pleated carriage embodiments. For example, at the carriage compact-station each of the shoulder members **10** lies in a direction transverse of the tracking means lineal finite-length; thus, each of the herein parallel shoulder members **10** substantially perpendicularly intersects a vertical-plane "VP" passing through and along the tracking means finite-length. The first-leg **11** and the second-leg **12** for any selected full pleat are attached to transversely separated locations of a pleat shoulder member **10** whereby a transversely extending given-breadth exists along the shoulder between intra-pleat legs and the respective intra-pleat legs are wholly located on opposite transverse sides of the vertical-plane "VP". The degree of relative longitudinal spreadility between intra-pleat legs **11** and **12** necessarily progressively increases toward their remote portions (i.e. nearer to inter-pleats bridges and remote from pleat shoulders **10**) inasmuch as intra-pleat legs **11** and **12** are joined to common shoulder members **10**. Moreover, during relative longitudinal spreading of intra-pleat legs **11** and **12**, they remain on opposite sides of vertical-plane "VP" and preferably within respective planes parallel to "VP". Each of the inter-pleats bridges **15** lies in a transverse direction at the carrier compact-stations and substantially perpendicularly intersects vertical-plane "VP". As is indicated in phantom line in FIGS. **1** and **2**, the longitudinal distance between shoulders **10** and bridges **15** increase as the pleated carriage becomes longitudinally extended by virtue of the relative longitudinal spreading of intra-pleats legs **11** and **12**.

The longitudinally extensible carriage "S", "SS", etc., is adapted to convey therealong one or more pleated paths of flowable fluid or power, If such pleated paths be of conduit form, the one or more conduits extend continuously uninterruptedly along the pleated extensible carriage. For example, as will be explained later in greater detail, a flexible conduit, such as **30**, that follows externally and continuously along consecutive carriage pleats might be employed whereby the external conduit transversely intersects vertical-plane "VP" at least twice when proceeding from the first-legs (**11**'s) of consecutive carriage pleats. If the shoulders **10** and the legs **11** and **12** of consecutively positioned full pleats, together with inter-pleats bridges **15**, be provided of intercommunicating tubular members as indicated in FIGS. **1–3**, then the carriage itself inherently provides an internal pleated conduit. In FIGS. **1** and **2**, the several carriage full pleats, the terminal half-pleats "S*a*"and "S*n*", and the five bridges **15** are all provided of intercommunicating tubular members connected by elbows **13**. Thus, water, air, or similar fluid might be introduced at the carriage relatively stationary inlet rear-end **16** and withdrawn from the carriage longitudinally movable outlet front-end **17**. Moreover, as indicated in FIGS. **4–4B**, a combination of internal and external conduits might be employed in pleated fashion along the same longitudinally extensible pleated carriage.

Consecutive incremental portions of the pleated carriage structure must be sufficiently structurally rigid to provide reciprocatable supports with respect to the tracking means, said incremental supports being preferably maintained at constant elevation. Herein, for the overhead horizontal tracking means **9**, there is an upright hanger **9W** extending integrally upwardly from a medial portion of the respective structurally rigid shoulder members **10**. At typical compact-stations each hanger **9W** extends parallel to and preferably along vertical-plane "VP" and has a wheel **9R** that is rollable along the rail longitudinally grooved portion **9T** whereby the shoulders **10** substantially perpendicularly transversely intersect "VP". However, if remotely forward portions of the elongate tracking means be curved (as indicated in phantom line at **9C**), then the shoulder **10n** at a location slightly forward of **10nc** would not be perpendicular to "VP". Herein, the several hangers **9W** are of similar upright length between wheel **9R** and shoulder **10**, and accordingly the several shoulders **10** remain at substantially constant elevation both at compact-stations and for longitudinally extended conditions of carriages "S" and "SS". The several first-legs **11** have a substantially identical leg-length from its connections **13** at shoulders **10** to bridges **15** whereby the several inter-pleats bridges **15** whereby the several inter-pleats bridges **15** remain at substantially constant elevation "D" from an underlying substrate "G" when the carriage is at a relatively collapsed compact-station. However, when the carriage of FIGS. **1–3** is being longitudinally extended, the bridges **15** move to progressively higher elevations e.g."DD". For a given carriage pleat, a leg-length must bear a ratio of at least two with respect to the shoulder member transverse given-breadth, and such ratio preferably exceeds four thereby providing more efficiently extensible carriages. In similar vein, the leg-length for both intra-pleat legs are preferably similar whereby the transverse inter-pleats bridges remain parallel to shoulder members **10**.

The several lengthy first-legs and second-legs preferably do not extend beyond the shoulder member and the interpleats bridge to which each respective leg is attached. Thus, when the pleated carriage is fully collapsed or retracted, minimal longitudinal space exists between consecutive shoulder members and between consecutive inter-pleats bridges thereby making for an exceedingly efficient carriage system. In this vein, there is preferably a pivotably associated relationship among the several consecutive carriage legs. Moreover, the respective legs are preferably sufficiently rigid structurally so as to remain kinkfree and within a given vertical plane as the carriage reciprocates along the tracking means. In carriage embodiment "S" of FIGS. **1–3**, the several elongate legs **11** and **12**, as well as

shoulders **10** and bridges **15**, comprise rigid metallic structural materials held together by intervening elbow-like connectors **13**. The pivotal relationship among the several consecutive legs is herein provided with swivel joints or rotatable connectors **14** interposed in series along the shoulders **10** and the bridges **15**. For example, as seen in FIG. **3**, bridges **15** might comprise two rigid lengths **15P** held together with a swivel joint **14**, and shoulders **10** comprise three rigid lengths held together with swivels **14** (with hanger **9W** therebetween). If the carriage pleats be made of tubular materials to provide an internal conduit, the swivels **14** might include a fluid-impervious gasket **14G**. However, it is to be understood that alternate kinds and locations of pivotal connectors e.g., **114,119**, (e.g. might be employed to provide the desired degree of longitudinal spreadability between intrapleat legs.

As had been previously alluded to, and as indicated in FIGS. **4–4B**, a plated conduit means might be of the external variety. It can be readily appreciated that external pleated conduits must be longitudinally co-extensible (and co-retractable) with the multi-pleats carriage itself. It is oftentimes desireable to utilize for the pleated conduit a relatively flexible material, such as a hose or an electrically conductive wire **30** extending continuously uninterruptedly along the respective carriage pleats. In such situation, there need be means to prevent inimical kinking, pinching, or other strain, upon the flexible conduit as the intra-pleats legs change in their longitudinal relationship during longitudinal extensions or retractions of the relatively more rigid multi-pleats carriage. In this vein, the continuously uninterrupted flexible conduit **30** best extends along the several carriage legs **11** and **12** and is firmly removably attached thereat as by clips **33** and **34**. However, the flexible conduit **30**, during its each transverse directional path from one carriage leg to the next leg thereof, is preferably loosely convex and detached from the carriage's proximal portion i.e. medial portions of shoulders **10** and bridges **15**. Thus, as the several intra-pleats carriage legs **11** and **12** become changed in longitudinal relationship, as the carriage is extended or retracted, the flexible conduit along each transverse directional path thereof does not become kinked, pinched, or otherwise strained, but instead is merely subjected to a gentle helical motion therealong as indicated in phantom line in FIGS. **4A** and **4B**. In order to ensure that desireable helical motion of the flexible conduit transverse-length, the average diameter of the flexible conduit should not exceed one-eighth the transverse-length. As indicated in FIG. **4**, the conduit transverse-length extends arcuately thereby exceeding the shoulder member **10** given-breadth by at least 10 percent.

The pleated extensible carriage embodiment "SS" of FIGS. **5** and **6** is generally analagous to carriage embodiment "S" of FIGS. **1–3**, and analagous numerical indicia are employed for embodiments "S" and "SS". For example, in embodiment "SS" there are: the consecutive full pleats "SSA","SSB","SSC",etc.; the rearward end half-pleat"SS*a*"; the forward-end half-pleat "SS*n*"a(not shown); the transverse shoulder members **110**; the inter-pleats bridges **115**; and the several legs **111** and **112**. However, instead of the swivel joints **14**, pins **114** are employed to provide a pivotal relationship between the two elongate intra-pleat legs **111** and **112** with their common shoulder member **110**. Pins **119**, similar to pins **114**, are employed to provide a pivotal relationship between legs **111** and **112** at the inter-pleats bridges **115**. In FIGS. **5** and **6**, each of the elongate legs **111** and **112** are structurally rigid electrically conductive metallic bars which directly revolvably contact the respective structurally rigid electrically conductive metallic pins **114** and **119**. Thus, if a source of electrical energy **116** is introduced at pin **114** at carriage half-pleat "SS*a*", electrical energy might flow in pleated bus bar fashion along consecutive members **114, 111, 119, 112, 114**, etc., of the pleated carriage "SS", and the electrical energy ultimately withdrawn at a terminal pleat "SS*n*"(not shown).

The hanger **9W** of FIGS. **5** and **6** has a molded electrically-insulative separator **9Y**. Such insulator **9Y** between uprights **9W** and **9WW** would permit the shoulder members **110** to be made of electrically-conductive structural material, and without thereby electrifying the tracking means **9**. It would, of course, be possible as a further safety precaution to provide the electrically-conductive metallic legs **111** and **112** with an electrically-insulative adherent outer sheath. Pins **114** as pivotal connectors might alternatively be provided in two isolated sections located at the two respective ends of shoulders **110**.

From the foregoing, the construction and operation of the pleated extensible carriage will be readily understood and further explanation is believed to be unnecessary. However, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact constructions shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the appended claims.

I claim:

1. A pleated extensible carriage adaptable for supporting at least one conduit therealong, said carriage being adapted to be employed in combination with and reciprocatably along an elongate tracking means therefor, the conduit extending in pleated fashion along and co-movable with the pleated carriage structure and having an inlet rear-end and an outlet front-end, the pleated carriage structure having a selectable relatively collapsed compact-station along a given finite-length of the tracking means whereat the respective carriage pleats are spaced relatively close together, said carriage structure commencing from a said compact-station thereof being forwardly longitudinally extensible along the tracking means whereby the respective pleats become spaced progressively far apart, said pleated extensible carriage structure at a compact-station thereof comprising:

A. A plurality of shoulder members respectively extending transversely of the tracking means of the tracking means and being longitudinally reciprocatably movable therealong;

B. Consecutively positioned carriage pleats comprising a said shoulder member together with a pair of elongate legs including a first-leg and a second-leg, each of said legs being attached to and extending uprightly from transversely separated locations of the shoulder whereby there is a transversely extending given-breadth between intra-pleat legs and

the intra-pleat legs have portions more remote from the said intra-pleat shoulder, there being a longitudinally spreadable relationship between intra-pleat legs the longitudinal degree of which becomes progressively greater toward the legs remote ends; and

C. Inter-pleats bridges located remote from the respective shoulders and extending transversely from the first-leg to the second-leg of consecutive pleats, the longitudinal distance between consecutive bridges becoming greater as the intra-pleat legs become increasingly relatively spread apart.

2. The pleated extensible carriage of claim 1 wherein the several transversely extending shoulders at a carriage compact-station are substantially parallel to each other and at substantially constant elevation, the shoulders of consecutive carriage pleats and the inter-pleats bridges intersecting a common vertical-plane; and wherein the several upright first-legs and second-legs of consecutive pleats have a leg-length bearing a ratio of at least two with respect to the shoulder given-breadth, the intra-pleat legs being located and remaining on opposite transverse sides of said vertical-plane whereby a pleated conduit along each carriage pleat transversely intersects said vertical-plane.

3. The pleated extensible carriage of claim 2 wherein the transversely extending shoulder member of consecutive carriage pleats is suspended by an upright hanger from the tracking means and the shoulder member is sufficiently structurally rigid to support the entire carriage pleat and the two inter-pleats bridges; wherein both of the intra-pleat legs of consecutive carriage pleats are linear structural members that depend from and are pivotably associated with the shoulder on opposite transverse sides of the hanger whereby the first-leg and second-leg of the same carriage pleat are adapted to be pivotably spread in opposite longitudinal directions from the same transversely extending shoulder; and wherein the first-leg and the second-leg of consecutive carriage pleats are pivotably associated at the inter-pleats bridge.

4. The pleated extensible carriage of claim 2 wherein the two intra-pleat legs of respective carriage pleats are substantially rigid linear members that remain in planes parallel to and located on opposite transverse sides of said vertical-plane as the carriage is being longitudinally extended and retracted.

5. The pleated extensible carriage of claim 2 wherein the shoulder and the two legs of respective consecutive carriage pleats and the inter-pleats bridges are provided of communicating tubular members whereby the carriage tubular structural members themselves additionally provide a pleated conduit.

6. The pleated extensible carriage of claim 5 wherein the two intra-pleat legs of respective carriage pleats are substantially rigid linear tubular members that remain in planes parallel to and located on opposite transverse sides of said vertical-plane as the carriage is being longitudinally extended and retracted.

7. The pleated extensible carriage of claim 6 wherein the two tubular intra-pleat legs of respective carriage pleats depend from the tubular shoulder member, at least one of the two intra-pleat legs of consecutive carriage pleats being pivotably associated with the shoulder and being of substantially like leg-length whereby the consecutive inter-pleats bridges are located at substantially common elevation, said bridges being at a higher common elevation when the carriage through said pivotal legs is longitudinally extended from a compact-station; and wherein the transversely extending shoulder member of consecutive carriage pleats is suspended by an upright hanger from the tracking means and the shoulder member is sufficiently structurally rigid to support the entire carriage pleat and the two inter-pleats bridges.

8. The pleated extensible carriage of claim 7 wherein both of the intra-pleat legs of consecutive carriage pleats are pivotably associated with the shoulder on opposite transverse sides of the hanger whereby both intra-pleat legs are adapted to be spread pivotably in opposite longitudinal directions from the same transversely extending shoulder; and wherein the first-leg and the second-leg of consecutive carriage pleats are also pivotably associated at the inter-pleats bridge.

9. The pleated extensible carriage of claim 8 wherein there is a flexible conduit extending uninterruptedly continuously in pleat-like fashion along at least two consecutive carriage pleats including externally along and attached to both intra-pleat legs, the transverse directional path of said conduit of a transverse-length extending along and loosely detached from said shoulder, said conduit transverse-length having an average cross-sectional dimension that is less than one-eighth the conduit transverse-length.

10. The pleated extensible carriage combination of claim 9 wherein for at least two consecutive carriage pleats the given-breadth of the two consecutive shoulder members and the leg-length of the two consecutive first-legs are substantially identical.

11. The pleated extensible carriage of claim 2 wherein there is a flexible conduit extending continuously uninterruptedly in pleat-like fashion along at least two consecutive carriage pleats including externally along and attached to both intra-pleat legs and also including a transverse directional path of said flexible conduit of a transverse-length extending along and loosely detached from a medial portion of said shoulder, said conduit transverse-length having an average cross-sectional dimension that is less than one-eighth said transverse-length.

12. The pleated extensible carriage combination of claim 11 wherein the said flexible conduit extends transversely along and is loosely detached from medial portions of the inter-pleats bridges.

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