

[54] **MECHANICALLY OPERATED
ERECTION STRUCTURE**
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Ohio
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[51] Int. Cl.E04h 12/34, B65h 75/00
[58] Field of Search242/54 A, 54 R; 52/108, 109,
52/110, 121, 2

3,434,674 3/1969 Groskopf.....242/54

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Attorney—J. G. Pere and L. A. Germain

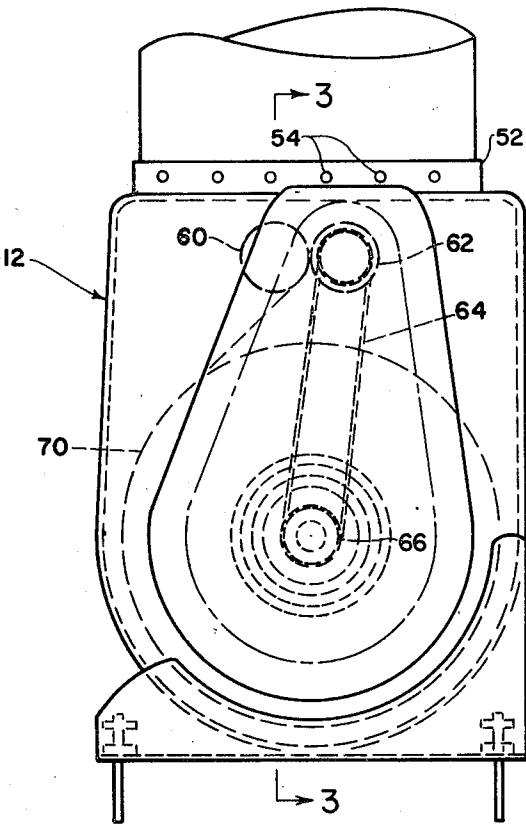
[57] **ABSTRACT**

The invention relates generally to extensible and retractable structure and more particularly to such a structure which may be used as a rigid support for loads applied axially thereof and/or laterally therealong, and where no fluid pressurization is required, but that stability is attained by the mechanical interrelation of the structure itself. Essentially, the bands of flexible curved metal are slidably interrelated and bent back on themselves to achieve the structural concept.

[56] **References Cited**

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6 Claims, 5 Drawing Figures



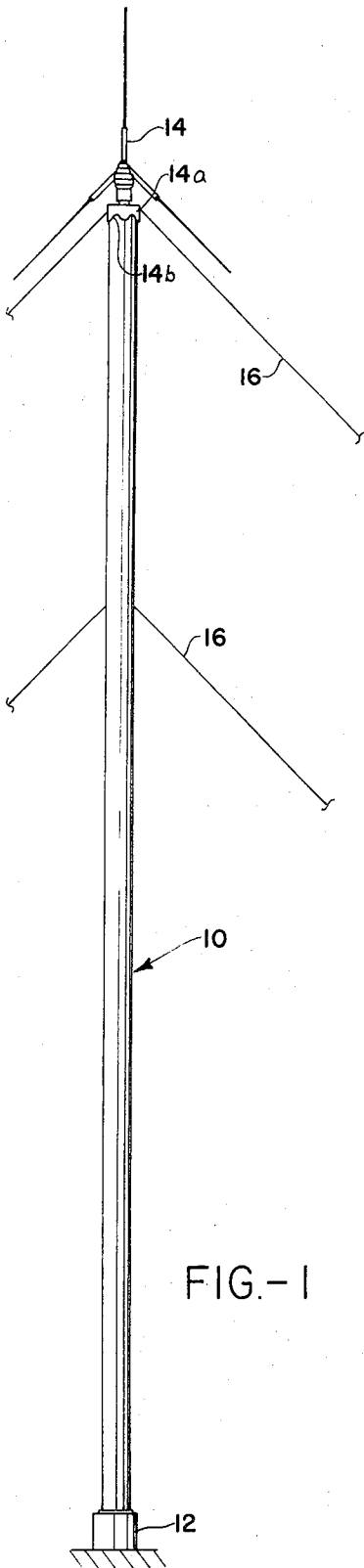
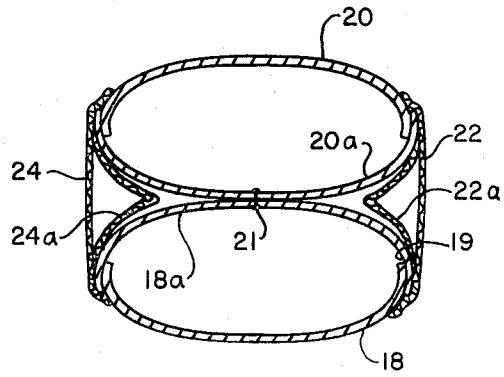


FIG.-4

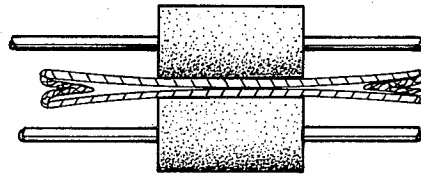


FIG.-5

FIG.-1

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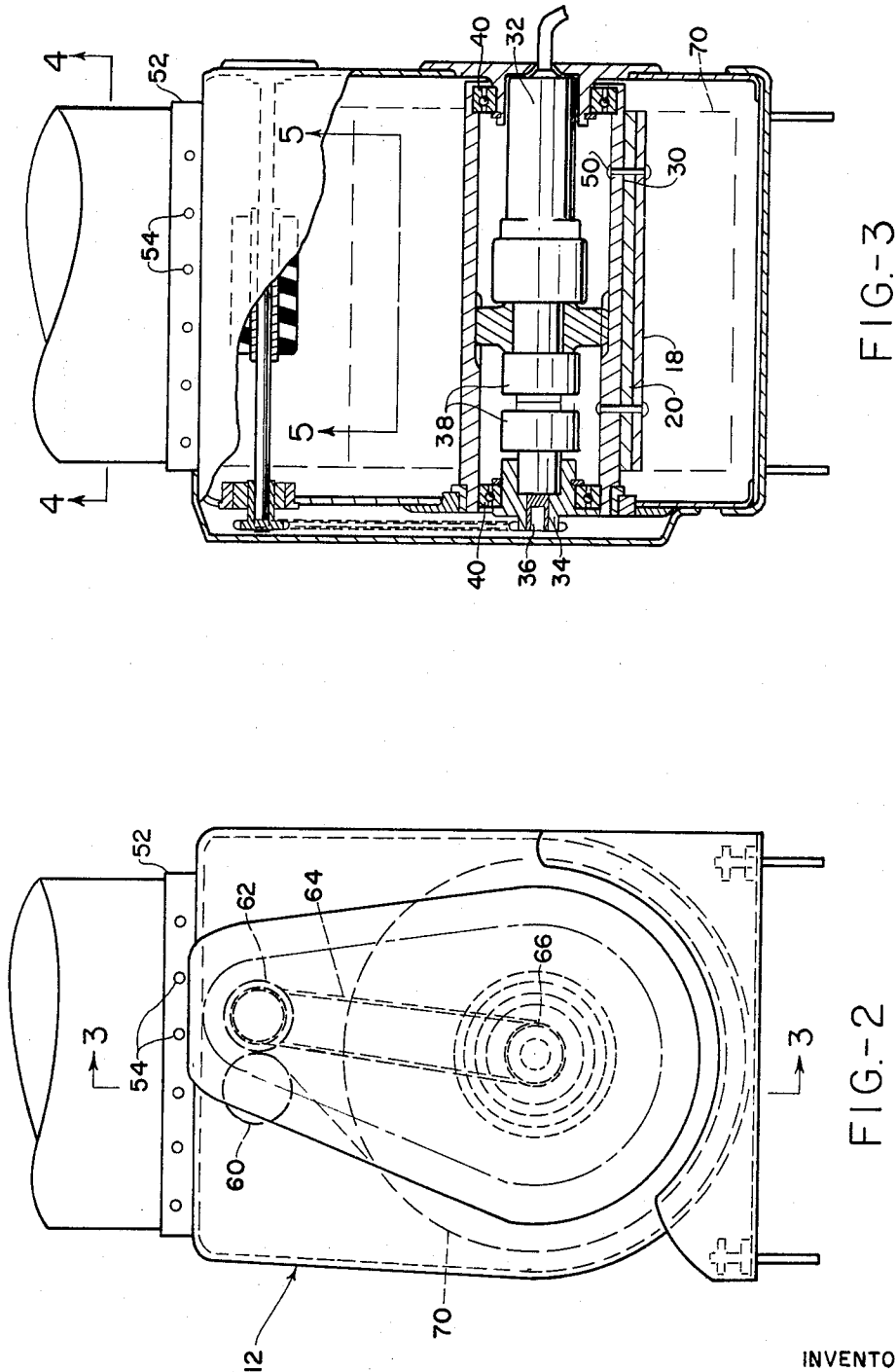


FIG.-3

FIG.-2

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MECHANICALLY OPERATED ERECTABLE STRUCTURE

Heretofore it has been known that there have been many and various types of mechanically extensible and retractable structures which have inherent rigidity in the structural properties thereof. However, most of these prior art structures have been characterized by being expensive to manufacture, having complicated structure to effect erection, and being quite non rigid when structures are erected over a long distance. The art needs a simplified, relatively inexpensive, and highly stable erectable structure which maintains its stability over a great length.

Therefore, the general object of the invention is to provide a mechanically erectable structure having great structural rigidity without pressurization, and where erection and retraction are simply and easily accomplished.

A further object to the invention is to provide an erectable structure which achieves its rigidity by bending curved spring type metal back onto itself so that all portions of the metal are under a constant bending load thereby greatly enhancing the structural rigidity.

The aforesaid objects of the invention and other objects which will become apparent as the description proceeds are achieved by providing a mechanically erectable structure which comprises a pair of curved stiffening members bendable on themselves arranged in opposed face to face relation to form a substantially elliptical shape in cross section, flexible fabric joining the edges of each member together, a frame holding one end of each member in position to the other, a pair of roller means within the frame defining a bite with the other ends of each member received in face to face relation into the bite, means to selectively drive the roller means to control retraction or extension of the members, and a take-up roller mounted in the frame to which the other ends of the members are tied, driven in synchronism with the rollers.

For a better understanding of the invention reference should be had to the accompanying drawings wherein:

FIG. 1 is an elevation of the structure of the invention utilized as a mast for supporting an antenna;

FIG. 2 is an enlarged broken away view of the base erection structure for the mast of FIG. 1;

FIG. 3 is a vertical cross sectional view partially broken away of the erection mechanism taken on line 3—3 of FIG. 2;

FIG. 4 is a plan cross sectional view of the mast taken on line 4—4 of FIG. 3; and

FIG. 5 is a plan cross sectional view of the mast and part of the erection mechanism taken on line 5—5 of FIG. 3.

With reference to the form of the invention illustrated in the drawings, the numeral 10 indicates generally a mast formed according to the preferred embodiment of the invention by being erected from a base storage member 12 and supporting an antenna 14. A plurality of guy cables 16 may be utilized simply to help stabilize the mast in the preferred vertical direction, but do not provide any structural support as such.

The erected portion of the mast itself is illustrated in FIG. 4 and comprises a pair of curved metal bands 18 and 20, preferably steel, although other suitable metals that possess spring like characteristics will meet the objects of the invention. Each of the bands 18 and 20 is actually a single band, but is curved over at the top end of the mast adjacent the antenna 14 back onto itself so that the inside bands 18a and 20a, respectively, are actually the other ends of bands 18 and 20. The essentially elliptical configurations between the inside and outside portions of bands 18 and 20 illustrated in FIG. 4 is achieved by connecting the adjacent ends of the adjacent bands with fabric panels 22 and 24, respectively. Again, those portions of fabric associated with inner panels 18a and 20a are identified by numerals 22a and 24a, respectively, although it should be understood that the fabric is also endless, and is only shown as separate pieces because of the cross sectional configuration illustrated.

However, one critical aspect of the invention is that the

bands or panels 18 and 20 preferably be made from spring steel and normally curved substantially as illustrated in the cross sectional views so as to give strength and rigidity to the thin panel when extended out over a long distance. The invention further preferably contemplates that the tie between the adjacent edges of the panels should be short enough so that the interior sections 18a and 20a are actually somewhat compressed towards a flattened condition to stretch the fabric panels 22 and 24 taut and actually bend the spring metal strips 18 and 20 back on themselves under tension which is only restrained by the fabric panels 22 and 24. This tension relationship along the length of the structure is important to the structural rigidity of the mast and insures that the inner sections 18a and 20a press firmly against each other in the back to back relationship illustrated.

As another important feature of the invention, the fabric 22 and 24 is suitably secured to the sections or strips 18 and 20, as by adhesive bonding, riveting, or the like, but at a spaced distance from the edge of each strip so that the edges of the outer strips curl inwardly to provide exposed grooves 19. The edges of the inside strips 18a and 20a are slidably received in the grooves 19 and thus lock the structure to a rigid integrity against bending while permitting relative sliding action to achieve extension and retraction.

The erectability and the retraction of the mast illustrated in FIG. 4 is shown in FIGS. 2 and 3. Essentially, the base 12 comprises a large rotatable drum 30 driven in rotatable relation by a suitable reversible motor 32 also preferably having a brake associated therewith to supplement motor 32. The invention incorporates a direct mechanical drive that is made through a sprocket 34 operating through a manual ratchet 36 and a reaction clutch 38, all in the conventional manner. The drum 30 is rotatably mounted to the base 12 by roller bearings 40.

One end of each of the metal bands or panels 18 and 20 are fixedly mounted to the drum 30 by suitable rivets 50, for example, as best seen in FIG. 3. Note the flattened relationship of these ends. The other end of each of these strips 18 and 20 is fixedly mounted to a concentric or annular base ring 52 mounted to the top of base 12, for example by suitable rivets 54. These ends form the relationship of the outer strips and are in a substantially semi-circular relationship as indicated by FIG. 4 of the drawings.

In order to reel the strips or panels 18 and 20 in or out, the invention provides a pair of erection rollers 60 and 62, with roller 62 being driven in synchronism by a chain 64 driven off a sprocket 66 that is connected directly to drum 30. The rollers 60 and 62 cooperate to effect a friction drive to the panel sections by having some type of rubber surface and normally holding the panels very firmly between the bite of the rollers. Normally, the invention also contemplates that the rollers 60 and 62 will only cover about the middle one-third section of each of the panels and effect the extension or retraction only on those sections so as not to totally flatten out the pannel on the erection in retraction which might tend to overcome the yield point of the spring panel sections. FIG. 3 very clearly shows this roller link relationship.

FIGS. 2 and 3 both illustrate the wrapped configuration of the panels around drum 30 by dotted line 70. Dotted line 70 might indicate the completely stowed or retracted position of the mast 10 for this particular embodiment of the invention.

It should be understood that the invention contemplates that the spring panels, strips or bands may be of any weight or thickness necessary to accomplish the structural requirements necessary for its intended use. The bands are preferably metallic, and spring steel, but a suitable plastic would also meet the objects of the invention. However, in the situation of an antenna support mast such as is illustrated in the drawing of perhaps 40 or 50 feet height and 2 feet in diameter, the invention contemplates that steel bands in the range of 0.003 to 0.020 inches could quite adequately handle the structural requirements necessary. It should be noted that since the bands do bend back on themselves at the top of the mast or structure as

it is extended or retracted, that a platform such as platform 14a having a cooperating bottom surface 14b can quite easily ride on top of the double curved end of the structure as it is moved to the desired height. The ones of the guide wires 16 attached to the platform 14a may be controllably shortened or lengthened to maintain the platform 14a at the top of the mast structure as the structure is raised or lowered.

It should also be understood that at the extended length of the structure the bands 18 and 20 are bent fully back on themselves and the cross sectional configuration shown in FIG. 4 of the drawings exists along the total length of the structure. For that interior portion of each band not having to pass the bent back curve at the end of the structure, the invention contemplates that the back to back relation of bands 18a and 20a will be spot welded or riveted together, as illustrated by rivet 21 in FIG. 4.

While in accordance with the objects of the invention, only the best known embodiment has been described and illustrated in detail, but it is to be particularly understood that the invention is not limited thereto or thereby, but that the inventive scope is defined in the appended claims.

What is claimed is:

1. A mechanically erectable structure which comprises:
 - a pair of curved stiffening members bendable on themselves arranged in opposed spaced face to face relation to form a substantially elliptical shape in cross section,
 - flexible fabric joining the edges of each member together,
 - a frame holding one end of each member in position to the other,
 - a take-up roller mounted in the frame, the other end of each of the members being secured to the take-up roller,
 - a pair of roller means within the frame defining a bite receiving the portions of each member extending from the take-up roller in face to face adjacent relationship, and
 - means for driving the roller means and the take-up roller in synchronization to control retraction or extension of the members.

2. The structure according to claim 1 where the curved stiffening members are spring steel having a gauge between 0.003 inches to 0.020 inches.

3. A structure according to claim 1 where the flexible fabric is of such length so as to compress that portion of the members bent back on themselves internally into an adjacent back to back flattened substantially X shaped configuration.

4. A structure according to claim 3 where the fabric attaches to the members at a slightly spaced distance from the lateral edges thereof thereby forming a groove between the edges and the point of fabric attachment, said internal portion of each member having its lateral edges slidably received into interlocking relation in such grooves.

5. A structure according to claim 3 which includes means holding those portions of each member that are in back to back relation at the full extension thereof in fixed relation to each other.

6. A mechanically erectable structure which comprises a pair of curved stiffening members resiliently bendable back through 180° onto themselves arranged in opposed spaced face to face relation to form a substantially circular shape in cross section,

frame means holding one end of each member in such face to face relation with the members having first portions extending upwardly from the frame means and second portions doubled back from the upper ends of the first portions and in back relation within the confines of the first portions thus forming each member into a substantially elliptical configuration in cross section,

means to grasp and move the second portions adjacent the point in which the second portions pass through the opening between the fixed ends of the members,

means to hold the members in substantially their same spaced face to face relationship along their lengths, and means to selectively move the second portions of the members through the means to grasp adjustably controlling the amount of extension of the members with respect to the fixed ends.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,669,368 Dated June 13, 1972

Inventor(s) James C. Bell, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 27, Claim 6, after "back" insert --to back--.

Signed and sealed this 17th day of October 1972.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents