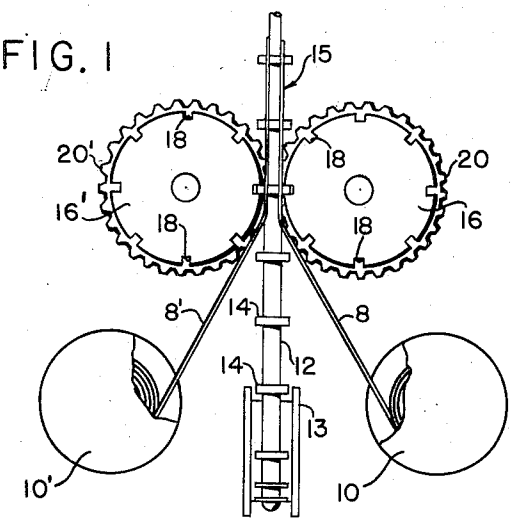
July 8, 1958 H. H. HALPERIN 2,842,768

EXTENSIBLE ANTENNA

Filed July 13, 1955 2 Sheets-Sheet 1

FIG. 1



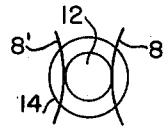


FIG. 3

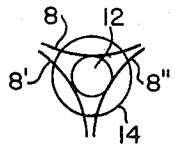
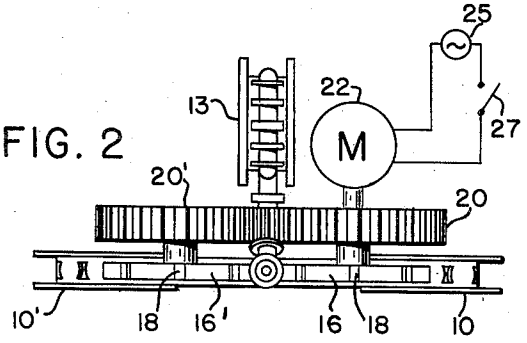


FIG. 4

FIG. 2



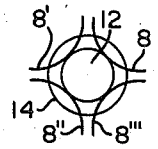


FIG. 5

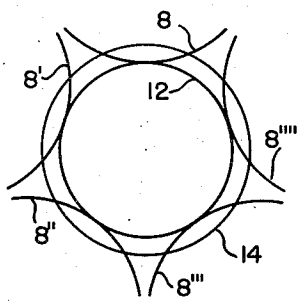


FIG. 6

INVENTOR.

HERBERT H. HALPERIN

BY

Leonard H. King

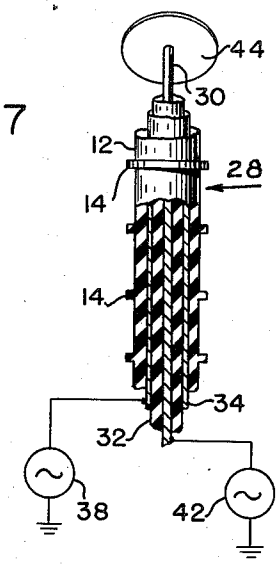
AGENT

July 8, 1958 H. H. HALPERIN 2,842,768

EXTENSIBLE ANTENNA

Filed July 13, 1955 2 Sheets-Sheet 2

FIG. 7



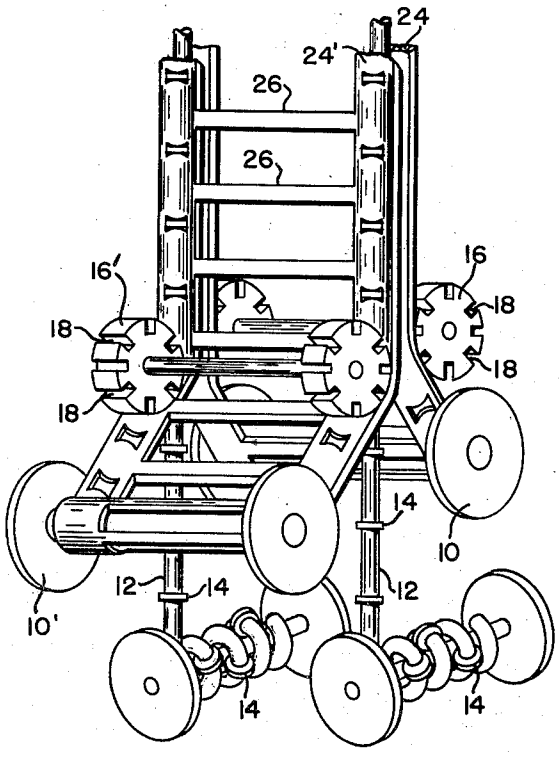


FIG. 8

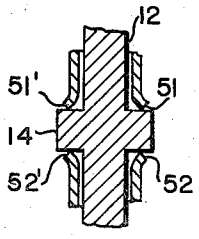


FIG. 9

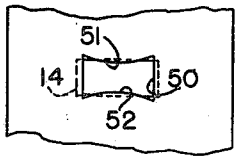


FIG. 10

INVENTOR.

HERBERT H. HALPERIN

BY

Leonard H. King

AGENT

United States Patent Office 2,842,768 Patented July 8, 1958

2,842,768

EXTENSIBLE ANTENNA

Herbert H. Halperin, Wantagh, N. Y., assignor to Sterling Precision Instrument Corporation, Flushing, N. Y.

Application July 13, 1955, Serial No. 521,769

11 Claims. (Cl. 343—877)

This invention relates to extensible support means and in particular, but not limited thereto, to extensible antennas.

A need exists for a simple lightweight mast which may be stored in but a small space and which may be quickly and positively erected to form a long rigid member. Prior art devices, for example, include antennas consisting of a number of concentric tubes which fit one inside the other in the collapsed position, and partially overlap in the extended position. Obviously, there are practical limitations to the small size to which the tubes may be formed if a long antenna is desired with but a minimum number of overlapping sections.

It is an object of this invention to provide an extensible support means.

It is another object of this invention to provide an extensible and retractable support means.

A particular object is to provide a simple, compact and rugged structure capable of erecting an antenna by mechanical means.

A special object of this invention is to provide a power-driven mechanism for automatically extending an antenna.

Another object of this invention is to provide a compact extendible ladder.

A still different object of this invention is to provide a multiple purpose extendible antenna.

A further object of this invention is to provide an extensible mast means which may be readily locked into an extended position.

With this and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a view taken in elevation of a typical embodiment of this invention with the housing removed so as to expose the special drive rollers and components of the extendible member of this invention in both the assembled and unassembled condition.

Figure 2 shows a plan view of the apparatus of Figure 1.

Figures 3, 4, 5 and 6 show in cross section embodiments of the assembled structure employing respectively two, three, four and five supporting tapes.

Figure 7 shows in elevation, and partially sectioned, a coaxial cable employed both as a core member and a means for exciting an antenna from independent sources of signal energy.

Figure 8 shows pictorially the instant invention embodied in a ladder.

Figure 9 shows in elevation a cross-section of a portion of another embodiment of the extendible member in erected condition, said embodiment including means for locking said extendible member in erected position.

Figure 10 shows in elevation the tape employed in the embodiment of Figure 9.

Briefly stated, the invention comprises an elongated flexible core member provided with a plurality of key members uniformly spaced along its length. A plurality of flexible tapes, such as the steel tape commonly used in coiled measuring rules, are provided with slots of such a size and spacing that they receive the aforementioned key members in a binding fit. Mechanical means are used to force the steel tapes into engagement with said key members so as to form a rigid assembly.

Referring now to Figure 1 there is shown perforated steel tapes **8** and **8'** supplied from spring loaded spools **10** and **10'**. Spool **10** may be of the type common to flexible steel measuring tapes. Flexible core **12** stored on reel **13** has affixed at uniformly spaced intervals annular members **14**. While not essential, an annular member is a preferred shape because of its inherent simplicity and because of its uniform aspect despite rotation of the core member **12** about its axis.

Erection of a rigid member **15** is accomplished through the use of mechanically synchronized drive rollers **16** and **16'** between which the two tapes **8** and **8'** are fed in a sandwich style configuration. The thickness of the annular rings **14** being slightly greater than the corresponding dimension of the slots in the tapes, an interference fit is effected. Dimensionally the recesses **18** in the drive rollers **16** and **16'** correspond to the dimensions of the portion of the annular ring extending through the slot in the tape **8**. The shape of the annular rings **14** and the drive rollers **16** may be like that of a spur gear and rack assembly in order to permit free entry and departure of the successive annular rings in the rotating drive rollers.

The drive rollers **16** bear against the annular rings **14** driving them and the inter-locked tapes in a tangential direction. The three units, i. e. two tapes **8** and **8'** and core member **12** are fed into rollers **16** and **16'** as individual components and leave them as a rigid member **15**.

The erected assembly is rigidly supported at its base by mechanical connection of the tapes **8** and **8'** to the reel spools **10** and **10'** and the fixing of the annular rings in the shaped recess **18** of the drive rollers **16** and **16'**.

While only two tapes have been shown as in Figure 2 other embodiments of this invention may be employed to further increase the rigidity of the erected column. In such case three, four, five or more tapes may be employed around one core as is shown in Figures 4, 5 and 6. A corresponding number of drive rollers **16** would be required.

The means of driving rollers **16** and **16'** in synchronism is shown in Figure 2 wherein meshed gears **20** and **21'** are coupled respectively to rollers **16** and **16'**. Motor **22** drives gear **20**. The motor is energized from source **25** and is controlled by switch **27**.

It will be noted that the component parts of the rigid assembly **15** are stored in very compact fashion on spools **10, 10'** and **13** which are small with respect to the extended length of the tapes **8** and **8'** and core member **12**.

The joining of the two tapes **8** and **8'** and the core **12** with its integral annular rings results in the formation of a rigid "I" beam mast as may be seen in Figure 8. The load carrying qualities of this "I" beam are effected by the ability of the steel tapes to carry the beam bending tension and compression loads usually carried by the flanges of an "I" beam. The horizontal shear loads usually carried by the web section of an "I" beam, can be effectively carried by the annular rings. Torsion loads can be effectively carried by the core. Preferably the tapes should have a concave, rather than flat cross-section.

For greater rigidity the core **12** should be of sufficient diameter to tangentially abut the tapes **10** when the structure is in the extended position. If this be done the shear loads are transmitted directly into the core **12** rather than through the cantilevered key members **14**.

The choice of material for the core and annular rings is governed by the application. For example in Figure 8, there is shown a ladder formed by utilizing two cores **12** and **12'** and a pair of dual tapes **24** and **24'** each respectively composed of a pair of tapes **10** joined by spaced rings **26**. The components are assembled by means of suitable drive rollers **16**. In this case the core may be a flexible metal cable and the annular rings of molded nylon plastic. A particular application of this invention (Figure 7) embodies a core **12** formed of a coaxial cable **28**, comprising an inner conductor **30**, insulation **32** braided metal outer conductor **34** and plastic outer insulation **36** having integrally molded rings **14**. Suitable plastics include, but are not limited to polyethylene vinyls and the fluorothene group.

A feature of this invention is the provision of an automatic antenna utilizing the mast of this invention. In one embodiment it may be used in conjunction with a radio beacon. Such a beacon for example may be used as an emergency device by aircraft forced down at sea. A suitable buoyant container, not shown, containing a transmitter **38** and the extendible means of this invention may be tossed out into the water. Switch **27** may be of a water responsive type so as to cause motor **22** to be energized from source **25** automatically erecting a whip antenna **40** formed by braid **34**. A second transmitter **42** may energize a second antenna **44** by utilizing inner conductor **30**. More conventionally the outer braid **34** may be used as a shield and the inner conductor **30** as the energizing conductor.

If metal tapes **8** and **8'** are employed then by electrically isolating them, they may be employed as antenna elements or as electrical conductors for exciting an antenna or even energizing a signal light.

The buoyant container may be so shaped as to float in a position adapted to maintain the antenna in an upright position. A further improvement within the scope of this invention is the incorporation of a gimbal mounting means for supporting the antenna in a vertical position.

In Figures 9 and 10 there is shown a tape slot **50** which is preferred for applications not requiring retraction of an extended structure. Annular ring **14** is shown in dashed lines. It may be appreciated that forcing the annular rings into this slot, causes the top and bottom lobes **51** and **52** to bend outwardly away from the direction of ring entry. The spring force of the two lobes prevents retraction of the ring.

In place of the steel tape referred to herein I may utilize other metal tapes or even non-metallic tapes possessing adequate tensile strength such as polymeric resin sheeting and reinforced resin sheeting. Typical suitable resins include nylon, semi-rigid polyvinyl chloride, cellulose aceto butyrate and ethyl cellulose.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim as my invention.

1. An extensible apparatus comprising in combination: a flexible elongated core member, a plurality of key members attached to said core member in spaced relationship to each other and a plurality of elongated flexible tape members having perforations adapted to receive said key members in an interference fit, said core member and said tape member being arranged in parallel relationship with said core member with said key members extending through said perforations.

2. An extensible apparatus comprising in combination: a flexible elongated core member, a plurality of spaced key members attached to said core member, a plurality of elongated flexible tape members having perforations adapted to receive said key members in an interference fit, erecting means for forcing said tape members into parallel relationship with said core member so that said key members extend through said perforations and means for supporting said tape members and said core member in operative relationship with said erecting means.

3. The apparatus of claim 2 wherein said erecting means includes a roller in contact with each of said tapes, said rollers being provided with recesses adapted to receive said key members and means for rotating said rollers in synchronism.

4. An extensible apparatus comprising in combination: a flexible elongated core member including at least one electrically conductive member, an electrically insulating flexible member provided with a plurality of spaced key members coaxially mounted with respect to said electrically conductive member, a plurality of elongated flexible tape members having perforations adapted to receive said key members in an interference fit, erecting means for forcing said tape members into parallel relationship with said core member so that said key members extend through said perforations and means for supporting said tape members and said core member operative relationship with said erecting means.

5. The apparatus of claim 2 wherein said key members are formed of a resilient material and said tapes are provided with elements for lockingly engaging said key members.

6. The apparatus of claim 4 wherein said core member includes an electrically shielded coaxial cable.

7. An extensible antenna comprising in combination: a flexible electrically conductive member, a flexible insulating member coaxial to said conductive member, a plurality of spaced key members affixed to said core member, a plurality of elongated tape members having perforations adapted to receive said key members in an interference fit, motor driven erecting means comprising a number of rollers, one of said rollers being provided in contact with each of said tapes, said rollers being provided with recesses for receiving said key members, means for rotating said rollers in synchronism, a motor connected to said last named means and arranged to actuate said means, a switch connected to said motor so that said motor is under control of said switch, and means for supporting said tape members and said core member in operative relation with said erecting means.

8. The apparatus of claim 7 wherein said switch is responsive to the presence of water.

9. A dual transmitting system comprising a flexible elongated core member including a pair of electrical conductive members, means for separately exciting each of said conductive members, an antenna element connected to one of said conductive members, an electrically insulating flexible member provided with a plurality of spaced key members coaxially mounted with respect to said electrically conductive members, a plurality of elongated flexible tape members having perforations adapted to receive said key members in an interference fit, erecting means for forcing said tape members into parallel relationship with said core member so that said key members extend through said perforations and means for supporting said tape members and said core member in operative relationship with said erecting means.

10. An extensible apparatus comprising in combination: a flexible elongated core member, a plurality of spaced key members extending from said core, a pair of elongated flexible tape members arranged on opposite sides of said core and provided with perforations adapted to receive said key members in an interference fit, a pair

of rollers provided with recesses adapted to receive said key members, one of said rollers being in contact with one of said tapes, a gear train in operative relation with said rollers so that they rotate in synchronism, a motor connected in operative relation with said gear train, switch means connected to said motor, and means for storing said tapes and said core.

11. The apparatus of claim 1 wherein said core member is in contact with said tapes.

References Cited in the file of this patent

UNITED STATES PATENTS

2,130,993	Dubilier	Sept. 20, 1938
2,147,991	Rusby	Feb. 21, 1939
2,239,614	Martin	Apr. 22, 1941
2,276,935	Como	Mar. 17, 1942
2,634,370	Carlson	Apr. 7, 1953
2,636,659	Salisbury	Apr. 28, 1953