To all whom it may concern:

Be it known that I, MARCEL GUICHARD, of 28 Rue de la Bienfaisance, Paris, Republic of France, engineer, have invented an Improved Pneumatic Telescopic Mast and Its Applications, of which the following is a full, clear, and exact description.

The telescopic masts ordinarily used, especially as pole-carriers for the wireless telegraphy or telephony stations, must be light in order to be easily portable, it is therefore necessary that their constitutive tubular elements should have the minimum weight and, for that purpose, a reduced diameter, consequently it is indispensable to provide them with shrouds so as to insure their stability.

These masts are generally constituted in such a way that, when extended, their constitutive elements rise in any order or successively in the increasing order of their diameters, that is to say with the element of smallest diameter issuing the first and that at the time of their telescoping into one another, these elements descend also in any order successively in the decreasing order of their diameters, that is to say with the element of largest diameter reentering first. In these conditions it is not possible to fasten the shrouds during the erection of the mast, it is necessary during this operation, in order to prevent the latter taking dangerous inclinations, to maintain all the shrouds and they may be fastened only after the complete extension of the mast.

In practice, this operation is long and difficult, it requires a large number of men the actions of whom must be coordinated and during the erection the mast may sometimes fall or be broken by reason of wrong handling. Moreover, during the reëntrance of the elements of the mast, it is necessary to maintain constantly all the shrouds during the descent of the elements.

Besides, it is to be noted that in the pneumatic telescopic masts it is absolutely necessary that the pressure of the air be maintained within the mast so that the latter remains extended and does not tend to reenter under the action of the strains which it undergoes.

The present invention has for its object a special device for pneumatic telescopic masts, so constituted as to remedy the above inconveniences and to be perfectly air-tight.

This device is made up so that, during the erection of the mast, its tubular elements rise successively in the decreasing order of their diameters, that is to say with the element of largest diameter issuing the first, the issue of an element beginning only after the termination of the upward movement of the preceding element and, during the reëntrance of this mast, these elements enter successively and entirely the one into the other in the reverse order to that of the extension, that is to say with the upper element of smallest diameter reentering the first, then the element which is immediately below and so on.

In these conditions, during the erection of the mast, the fastening of the shrouds can be effected in proportion to the issue of the elements and then only the set of shrouds following that which has just been fastened will have to be handled at a time and during the reëntrance of the mast, the latter is always maintained by the shrouds secured to the elements situated below the reëntrancing elements.

The present invention is essentially characterized by the application at the upper part of the mast of any device allowing or capable of exerting upon this element a vertical downward stress; under the action of this stress, all the movable elements of the mast, during the erection of the latter, become integral with one another and issue as a block from the base element, then these elements separate successively the one from the other in the decreasing order of their diameters, the ascending group of elements separating from the lower element only after the complete issue of the latter. Moreover this vertical stress has for effect, during the reëntrance of the mast, to compel these elements to successively enter the one in the others in the increasing order of their diameters.

This device may consist in the application at the upper part of the mast of a rope, chain, etc., for exerting a downward
traction upon said mast or of a heavy charge at the top of this mast.

The present mast is also characterized by the application to each sliding element of a special device insuring the perfect air-tightness and thus allowing the mast to remain extended.

This device comprises further a flanged joint having a conical shape, arranged in such a way that its lower edge only is in contact with the inner wall of the tube in which it slides; in these conditions, the entire inner surface of this flanged joint, upon which is exerted the pressure of the air compressed within the mast, participates in energetically applying the lower edge of this joint against the wall of the tube on which it moves.

Moreover, in order to prevent the introduction of foreign bodies, dust, water, etc., which might cause leakage, each element is provided at its upper part (except the last element constituting the top of the mast) with a flexible ring, mounted by means of a special device which prevents it from being subjected to the mechanical reactions of the mast.

The present type of mast comprises also a special type of lining allowing, if necessary, to easily and rapidly do away with one or several elements without affecting the air-tightness and the good working of the mast.

This type of pneumatic telescopic mast is capable of receiving various applications; it may be used as a pole-carrier for the wireless telegraphy and telephony stations, it allows also to obtain a portable observatory, which is light, very movable and of small visibility; in the latter case, at the top of the last element is arranged either a seat on which the observer sits or a platform of special construction provided with a seat, back, hand-rail and tablet allowing the observer to install himself for a prolonged time and to make use of optical apparatus, to take sketches, etc.

The accompanying drawings illustrate by way of example the subject-matter of the present invention:

**Figure 1** is an elevation showing the mast extended;

**Fig. 2** illustrates the mast collapsed;

**Fig. 3** is a cross section taken on line A—A, Fig. 1;

**Figs. 4 and 5** are two detail views made on a greater scale, illustrating respectively in vertical section a portion of the mast in its extended position and in its folded position;

**Fig. 6** is another detail view showing a device permitting of doing away with one of the tubes of the mast;

**Fig. 7** illustrates a special observation seat mounted at the upper part of the mast;

**Fig. 8** is a horizontal section showing the mast provided with a flange adapted to serve as a guide for the rope ladder allowing to gain access to this seat;

**Fig. 9** is a detail plan view showing the beam of the pumps adapted to compress the air within the mast.

As illustrated in the drawings, the present type of mast is composed of steel tubes \( a, a', a'' \ldots a'\) sliding the one into the others while forming an airtight capacity of variable volume; the number of these tubes may vary and depends on the maximum height the mast must reach.

The lower tube \( a \) and the upper tube \( a'\) are closed at their lower part.

Each of the sliding tubes \( a', a'' \ldots a''') \) is provided at its lower part with an airtight lining constituted and mounted in the following manner:

At the lower end of each of these tubes is fitted a plug \( b \) secured within the tube by a forced in portion \( e \) constituted as illustrated in Fig. 4 and insuring a perfectly airtight joint. Against the outer face of this plug is fitted a flanged joint \( d \), of conical shape, secured by means of a clamping member \( e \) presenting a central core \( e' \) which fits in a corresponding recess provided in the plug \( b \); a bolt \( f \) insures the fastening of the plug \( b \), of the flanged joint \( d \) and of the clamping member \( e \).

Channels \( g, h \) are provided in the clamping member \( e \) and in the plug \( b \) of each tube in order to allow free communication of the tubes between them.

By reason of the conical shape of the flanged joint \( d \), the edge of the latter is fitted in a very fine manner against the inner wall of the tube against which the joint moves; and in these conditions no leakage is possible.

The plug \( b \) is provided with a ledge \( j \) on which rests a sleeve \( j \) of small length, located in the annular space situated between the tube carrying this plug \( b \) and that in which it slides, said sleeve being adapted to limit the extension or development of the sliding tube.

At its upper part each of the tubes \( a, a', a'' \ldots a''') \) carries a collar \( k \) in which it is set (Fig. 11); on this collar is secured a washer \( f \) the inner diameter of which is slightly greater than the outer diameter of the sliding tube. This washer serves as an abutment for the sleeve \( j \) when the sliding tube has reached its maximum of travel.

For the purpose of preventing the introduction within the mast of foreign matters, dust, water, etc. each tube, except the last, carries at its upper part an elastic ring \( m \) (Figs. 4 and 5) made of brass for instance and the inner diameter of which is such that
the sliding tube rubs against the inner edge of this ring. This ring rests upon the washer and is simply maintained by a washer secured on the preceding washer with a slight transverse play so as to be capable of following the small transverse movements of the sliding tube. A headed screw insures the fastening of the washers and of the collar.

The last tube is provided at its upper part with a collar constituting a cap.

The collars of the various tubes and the cap of the last tube have all the same outer diameter; they are provided on their inner face with a circular recess receiving the heads of the screws of the collar of the preceding tube when the mast is collapsed as illustrated in Fig. and are capable of fitting the one upon the others.

The superposition of the various collars constitutes a closed casing insuring a complete protection of the movable elements of the mast when the latter is collapsed.

The collars of the various tubes, or of certain tubes only, are provided with screw-rings (Figs. 1, 2, 3) to which are secured the shrouds adapted to insure the fastening of the mast.

For the purpose of allowing a vertical downward stress upon the mast at the time of the extension or folding down of the same, a rope, a cable or a chain is secured to the upper element of the mast and is guided in the screw-eyes carried by the collars of the tubes.

The compressed air is forced into the mast by means of two pumps operated by a beam which can be easily taken off. This beam is composed of two flat irons each carrying at one of their ends a handle presenting at their other end a notch and perforated with three holes (Fig. 9). For mounting the beam, the two flat irons are placed on each side of the lower tube, the notched end of each of these irons being arranged opposite the handle of the other, then by a small movement of one member relatively to the other the axis of the handles are caused to enter into the adjacent notches; the two branches are then slightly spaced apart so as to cause pins carried by the pinion rods of the pumps to enter into the holes and studs provided on the tube (Fig. 1) to enter into the holes.

In order to extend or develop the present type of mast when it is collapsed (Fig. 2) the operation is as follows:

The pumps are actuated so as to force air in the tubes, taking care of exerting a traction on the cable.

The whole of the tubes forming an airtight chamber of variable volume, the support extends itself under the action of the air pressure and, under the effect of the vertical stress exerted downwardly by means of the cable on the upper element of the mast, the various tubes extend themselves successively in the decreasing order of their diameters, that is to say the whole of the elements ascend first as a single tube, then the elements ascend, are successively arrested by their respective sleeves as above explained.

In these conditions, during the erection of the mast, the fastening of the shrouds may be effected in proportion to the issue of the elements.

When the mast is entirely extended the air inlet cock is closed, said cock being arranged at the lower part of the tube.

For folding down the mast, a cock is opened, this cock being also mounted at the lower part of the tube and the inner element of the mast into communication with the atmosphere; traction is also exerted, as previously, on the cable, so as to compel the tubes to reenter the one into the other in the increasing order of the diameters, that is to say with the upper tube of smallest diameter beginning to descend alone, the other elements remaining extended or developed under the action of the inner pressure.

When this element has entirely reentered, the element descends in its turn, then the element and so on. In these conditions, the mast may be retained in its vertical position during its collapsing, by the shrouds secured to the elements located below the descending elements.

In case of damage or for any other cause, it is possible to do away with any one of the intermediate tubes of the mast.

If it is desired for instance to dispense with the tube and the upper washers of the intermediate tubes and the clamping member at the base of the tube and its clamping member at the base of the tube are then replaced by intercalating a cylindrical lining the interior diameter of which is slightly less than the inner diameter of the tube. A washer of leather or other material may be interposed between the base of the lining and the lower face of the plug of the tube; the whole is clamped by means of the plug, as illustrated in Fig. 6.

The conical flanged joints are then removed and also the clamping members of the latter, mounted at the base of the tube and the flanged point originally secured at the base of the tube and its clamping member at the base of the tube are then replaced by intercalating a cylindrical lining the interior diameter of which is slightly less than the inner diameter of the tube. A washer of leather or other material may be interposed between the base of the lining and the lower face of the plug of the tube; the whole is clamped by means of the plug, as illustrated in Fig. 6.

The tube thus modified is fitted in the tube and the whole of the washer and the elastic ring and the counter-washer originally secured on the collar of the tube is mounted on the collar of the tube.
By the same method any number of tubular elements of the mast may be dispensed with.

The present type of mast is capable of receiving many applications: it may be used especially as pole-carrier for wireless telegraphy, as supports for apparatus for optical telegraphy, as supports for projectors, etc.

It may be used also for the constitution of posts of observation; in this case, the last element carries at its upper end a platform with seat and hand-rail.

Fig. 7 shows a special method of realization of this post of observation.

This post comprises a bent tube 1 forming the main support and carrying at its lower part transverse flat irons 2 upon which rests a floor 3. On these flat irons are secured two uprights 4; the latter and the tube 1 carry a hand-rail comprising an upper frame 5 and a bent rod 6 arranged below said frame and cut off on the rear face of the post. This rod supports a rocking seat 7 capable of oscillating at one of its ends on one of the side branches of the rod 6 and provided at its other end with hooks 8 taking a bearing on the other side branch of this rod. Moreover the said seat carries a counterweight 9 so arranged as to maintain it in its raised position. The carrier-tube 1 extends below the floor 3; this extension 10 is fitted into the upper tubular element of the mast.

The upper-frame 5 of the hand-rail carries a tablet 11, allowing the observer to take notes, sketches etc., and a rod 12 adapted to support the various optical apparatus which the observer may have to use.

To the irons 2 of the floor of the platform is attached a rope ladder 13 allowing to gain access to the latter or go down when the mast remains extended. This ladder is preferably guided by flanges 14 secured on the upper collars of the constitutive tubes of the mast (Fig. 8); these flanges insure the regular unrolling of the ladder during the erection of the mast and prevent its lateral displacements.

In this case, the ladder may also be used for fulfilling the same function as the rope or cable above described, that is to say for exerting a downward vertical traction on the mast during its extension or its collapsing, as previously explained.

The present type of pneumatic telescopic mast is capable of receiving any other applications; the form, sizes and detail devices of its constitutive elements may be modified according to these applications.

Claims:

1. A pneumatic telescopic mast comprising in combination a plurality of tubular elements collapsible within each other, means for maintaining air-tight joints between the same, guys fixed to a plurality of said tubular elements, manually operated means attached to the uppermost tubular element and adapted to exert vertical traction force at the apex of the mast during extension or collapsing of the mast.

2. A pneumatically operated mast comprising in combination tubular elements telescopically associated to slide within each other to permit extension and collapsing of the mast, means for maintaining air-tight joints between said tubular elements, a plurality of guy elements fixed to said tubular elements, and a traction member attached to the upper member of the mast adapted to permit an ascending vertical traction strain on the tubular elements during extension and collapsing of the mast.

3. A pneumatically operated mast comprising in combination a plurality of tubular elements telescopic ally associated to slide within each other, means for maintaining air-tight joints between the same, guy elements attached to the upper end of each tubular element, a traction member attached to the upper tubular element to cause vertically ascending traction strain during the extension or collapsing of the tubular elements, and guides to receive said traction element secured to said guy elements.

4. A pneumatic telescopic mast comprising in combination tubular elements sliding the one into the other,—a conical flanged joint mounted at the base of each sliding element by means of a plug on which the said element is secured by setting and of a clamping member presenting a central core fitted into a recess provided in the plug,—a collar secured to the upper part of each tubular element, a washer secured on the outer face of said collar, flexible means mounted on said washer for engaging the tubular sliding element, the said collars being provided on their inner faces with circular recesses and adapted to fit one upon the other when the mast is collapsed,—and means for exerting at the upper part of the mast a vertical downward strain during the extension or the collapsing of the mast.

5. A pneumatic telescopic mast comprising in combination tubular elements sliding the one into the other,—a conical flanged joint mounted at the base of each sliding element,—a collar secured to the upper part of each of the tubes,—a washer secured on this collar and internally bored according to the outer diameter of the element sliding in this tube,—an elastic ring mounted with a slight transverse play on this washer and against which rubs the sliding element, the collars of the various tubes having a uniform outer diameter and being arranged to fit the one into the other when the mast is collapsed,—
and means for exerting at the upper part of the mast a downward vertical strain during the extension or the collapsing of the mast.

6. A pneumatic telescopic mast comprising

in combination tabular elements sliding the one into the other,—a conical flanged joint mounted at the base of each sliding element,—a collar secured to the upper part of each of the tubes,—a washer secured on this collar and the inner diameter of which is slightly greater than the outer diameter of the element sliding in this tube,—an elastic ring mounted with a slight transverse play on this washer and against which rubs the sliding element, the collars of the various tubes having a uniform outer diameter and being arranged fit the one into the other when the mast is collapsed,—a sleeve located in the annular space situated between each tube and that in which it slides in such manner that the said sleeve, abutting on the one hand against a shoulder presented by the plug mounted at the base of the sliding tube and on the other hand against the washer of the tube in which the latter slides, limits the development of this sliding tube,—and means for exerting at the upper part of the mast a downward vertical strain during the extension or the collapsing of the mast.

The foregoing specification of my improved pneumatic telescopic mast and its applications, signed by me this tenth day of January 1916.

MARCEL GUICHARD.

Witnesses:
CHAR. P. PRESSLY,
EMILE BERTRAND.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D.C."