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(54) **A POLE STRUCTURE**

PFEILERSTRUKTUR

STRUCTURE DE PYLONE

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(56) References cited:
WO-A-87/05962 **DE-A- 2 935 618**
DE-B- 1 142 693 **US-A- 4 314 434**

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Description

The present invention relates to a pole structure intended for supporting power lines, telephone lines, cable conveyers, antennas or as portal posts, lamp posts or the like, said post structure comprising a separate, open metal profiled section or two open metal profiled sections which are positioned generally symmetrically or symmetrically in relation to an intermediate vertical plane and which have two legs, a polygonal cross-section and a longitudinally extending symmetry plane.

The impregnated, wooden post is the most common type of power-line and telephone-line supporting pole or post in present day use. In addition to these poles being bulky and difficult to transport because of their length, the reduced availability of suitable wood for the manufacture of such poles has resulted in long delivery times. The poles are normally impregnated creosote or arsenic, in order to guard against biological attack from fungus, insects and other vermin and infestants. These impregnating agents, however, increase contamination of the soil and waterways, and may also cause allergies. Creosote also contains carcinogenic substances. It is quite probable that the use of creosote and arsenic-based impregnating agents will be banned at some future date and that the use of impregnated wooden poles will be subjected to environmental charges and fines and stricter handling controls, therewith increasing the need and demand for other types of poles or posts, such as concrete poles, lattice-structure metal poles, tubular metal poles and poles constructed from open metal profiled sections.

Concrete poles are produced, for instance, by centrifugal casting techniques, i.e. a manufacturing method which places a relatively high demand on resources. Because of their heavy weight and bulky dimensions, concrete poles are difficult to transport and erect, particularly in dense forest country. Furthermore, this type of pole requires much stronger bracing wires than wooden poles for instance. The passage of time results in the formation of cracks in the concrete surfaces and those poles which are placed in wet ground stand the risk of frost damage.

In general, metal poles of latticework construction are comprised of a large number of elements which are joined together during manufacture and/or in conjunction with erecting the pole. The work entailed in joining and fitting these elements together is relatively complicated and the large number of joins entailed increase the risk of fracture around these parts. The configuration of the latticework structure also renders the structure sensitive to icing and corrosion.

The tubular metal poles are normally used for street lighting and are not normally suitable for use as power cable poles or antenna masts, since the requisite length of such poles, or posts, and the high loads to which they are subjected presumes the use of a relatively heavy gauge plate, resulting a high material and manufactur-

ing costs. The closed cross-sectional configuration of such posts also renders the post susceptible to condensation, which is a drawback from the aspect of corrosion, and also makes inspection of the poles and internal drawing of wires and cables therethrough difficult, for instance.

Through WO87/5962 there is known a pole structure in the form of a mast for use in sailing yachts. This mast should solve the problems of manufacturing aluminium alloy extruded masts, by building a mast of two "rolled formed" profiles, mounted together by means of spacers. By this the usual welding, u.a. to get the tapering of the mast, is largely eliminated, thereby reducing the problems of reduced strength factors. Due to the need of two mast profiles and the tapered form of the mast this pole structure is expensive to manufacture and is not suitable for mass production of cantilever, high loaded poles to be used according to this invention.

The object of the present invention is to provide an environmentally friendly pole structure to which access can be had readily for inspection and cable drawing purposes and which has a relatively low weight and good stability in all directions appropriate to the purpose for which the pole is intended, and also a pole which can be readily manufactured, assembled and transported, and also a pole which will fulfil all of the requirements concerning resistance to corrosion, mechanical strength and useful life in respect of poles subjected to high loads in outdoor environments.

Accordingly, the present invention provides a pole for use in supporting power cables, telephone lines, cable conveyors, antennas or for use as portal posts, lamp posts or the like, said pole, or post, comprising a separate open metal profiled section, said profiled section having two legs, a polygonal cross-sectional shape and a longitudinally extending symmetry plane, braces or ties are arranged between surface parts which are located substantially equidistant from the symmetry plane and connected to the ends of said tie.

According to the invention, the metal profile or section of the post is provided with two longitudinally extending planar stiffening flanges which are disposed symmetrically in relation to the symmetry plane of the profile or sections, so as together with the ties provide increased stability in the cross-direction of the pole.

The profile will preferably have a cross-sectional shape which either forms an open polygon of truncated U-shape or U-shaped extension, circular extension, or a cross-sectional shape of truncated V-shape or V-shaped extension.

The surface parts to which the ends of the ties are connected may either be located along the corners of the section or sections from which the flanges extend or along side parts of respective flanges or legs.

According to another embodiment, the ties are arranged horizontally and spaced apart at stepping distances, so that the ties, or braces, can also be used as step means when climbing up and down the pole.

According to another embodiment of the invention, the pole is divided into sections, which may have mutually different cross-sectional shapes. In order to facilitate movement and erection of a pole assembly which either includes or does not include a pole supporting element, the assembly may be made collapsible by mounting pivotal connecting devices between the pole and the support surface and/or between two pole sections. When the pole is erected, the upper section of the pole may be placed at an angle of up to 100° in relation to the remaining sections, thereby enabling the pole, or post, to be used as a portal post, a street lighting post or the like.

An inventive pole is suitably comprised of one polygonal metal section made of folded steel plate reinforced, or braced, with stepping pins and provided with bar flanges which are either welded to the section or formed integrally therewith, said pole either being manufactured in sections or in a single length. When the pole is manufactured in sections, each of said sections is configured so as to enable it to be fitted to another section simply and quickly, such that the resultant pole will have good stability in the requisite directions. For economic reasons and for ease of transport, an advantage is afforded when the pole, which may have a length of from 10-24 m, is assembled from a plurality of not over-bulky pole sections in conjunction with handling the pole, each of these sections preferably having a length of about 4 to 10 m. The sections of an erected pole are mutually connected in an appropriate manner, and the lowermost section is fixedly mounted to a pole supporting element or foundation element particularly intended for this purpose, said support normally having a length of 1.5 to 3.5 m.

The inventive pole has a large number of important advantages over the conventional wooden pole or post. For example, since this pole of long construction is comprised of several less bulky sections, these sections can be transported in an unassembled state or folded down one upon the other, pivotally mounted together. Since the material from which the inventive pole is made is in comparatively good supply, delivery times are shorter and the fact that long poles are manufactured in sections reduces storage volumes and eliminates long storage costs. The pole is constructed and dimensioned for a useful length of life of about 40 years and the sections can be exchanged or reused in another pole structure. Furthermore, it is not necessary to impregnate the pole with an impregnating agent, which is an advantage from the aspect of working and natural environments. Furthermore, the pole can be provided with stepping pins to facilitate climbing of the pole without needing the use pole clamps.

In comparison with concrete poles, the inventive pole has several important advantages from the aspect of pole manufacture and pole handling, since the pole is preferably manufactured in sections of thin, folded metal sheet of relatively low weight.

Compared with metal poles of latticework construction, the inventive pole has important assembly advantages, since the number of parts to be joined together are fewer than in the case of latticework constructions. Since the diagonal and horizontal surfaces are also fewer in number, there is also less risk of icing and corrosion.

As opposed to the tubular metal poles, the inventive pole has an open cross-sectional form which means that the pole is self-ventilating and therewith less susceptible to corrosion. Furthermore, the metal profile is flexurally rigid in all important directions, despite being constructed from a relatively thin metal plate, which affords good stability both in the longitudinal and transverse direction, at reasonable cost.

The present invention will now be described in more detail with reference to an exemplifying embodiment thereof and also with reference to the accompanying drawings, in which Figure 1 is a side view of an inventive pole erected on a pole supporting element, said pole comprising three sections and including a single metal profile having two flanges; Figure 2 is a front view of the pole shown in Figure 1; Figure 3 is an enlarged, radial cross-sectional view of component parts of a pole section according to Figures 1 and 2, in which the metal profiles form an open nine-cornered configuration of essentially U-shaped extension; Figure 4 illustrates an alternative cross-sectional shape in which the profile forms an open eight-cornered configuration of generally truncated U-shaped extension; Figure 5 illustrates an alternative cross-section in which the profile forms an open eleven-cornered configuration of generally circular extension; Figure 6 illustrates an alternative cross-sectional in which the profile forms an open three-cornered configuration of substantially U-shaped extension; Figure 7 illustrates another alternative cross-section in which the profile has a generally truncated V-shaped extension, and Figures 8 and 9 illustrate enlarged views of the joins between the upper pole sections in Figures 1 and 2 respectively.

Figures 1 and 2 illustrate an inventive pole assembly which consists of three pole sections 21, 22, 23 and a pole supporting element 20, wherein the two lower sections 21, 22 are joined together by means of a bolt joint 25 with the aid of horizontal attachment plates 26 welded to each section, and wherein the pole supporting element 20 and the bottom section 21, similar to the two remaining sections 22 and 23, are mutually joined together by means of connecting devices 24 which enable the pole assembly to be collapsed. Each section 21, 22, 23 includes a polygonal metal profile 1 having a longitudinally extending opening in which braces or ties 12 are mounted horizontally at stepping distances from one another, so that the ties can be used for climbing up and down the section. In the case of another embodiment, however, the ties are mounted diagonally, for example.

As will be seen from Figures 3-9, the inventive pole is comprised of a separate, open metal profile 1, 2, 3, 4

or 5. All profiles 1, 2, 3, 4, 5 include two legs 8 or 9 and have a polygonal cross-section and a longitudinally extending symmetry plane 11.

The profiles 1-5 are provided with two longitudinally extending planar stiffening flanges 14, 15 or 16 which are arranged generally symmetrically in relation to the symmetry plane 11. With regard to the profiles 4 and 5 the stiffening flanges 16 are welded to corresponding legs 8. The flanges 16 are normally formed from a heavier gauge metal plate than the legs 8 and, according to current standard, the horizontal width of the legs should be about ten times greater than the leg thickness. In remaining embodiments, the flanges are comprised of folded or bent end-parts of the metal profile, wherein, according to current standards, the horizontal width of the flanges will be about 10 times the plate thickness of the profile legs.

Braces or ties 1, 2, 3, 4 or 5 are suitably welded between surface parts located generally equidistant in relation to the symmetry plane 11.

The surface parts to which the ends of the ties or braces are welded are located along the outer longitudinally extending corner edges 17 between the legs 8 or 9 and the flanges 14 formed along the bend, in the case of the profiles 1, 3 and 6. In the case of the profiles 2 and 7, said surface parts are located along the outer, longitudinally extending side-parts 18 of the leg or legs 9, while in the case of the profiles 4 and 5, said surface parts are located along the longitudinally extending side-parts 18 of the flanges 16.

In the case of a pole which has a length of about 15 meters (not including the pole supporting element) and an embodiment according to Figures 1-3, the pole cross-section will preferably have the following approximate measurements: plate thickness 4 mm, inner bending radius 10 mm, flange 40 mm, stepping pin 210x110 mm, leg 110 mm and connecting profile side 160 mm, and remaining profile sides (with bending angle 36°) 140 mm.

The U-shaped profiles shown in Figures 3 and 4 are particularly suitable when the loads acting parallel to the symmetry plane 11 are slightly greater than those loads which acts perpendicularly to the same plane, which normally applies to a pole which carries power lines and the power lines extend parallel with the symmetry plane shown in the Figure. The angle subtended by the legs 8 or 9 and the outer connecting profile side may be even greater, suitably about 100°, than the right angle shown in the Figures. The profile according to Figure 4, however, should have slightly thicker walls compared to the profile shown in Figure 3.

A pole section of circular cross-section, according to Figure 5, can be used when the loads that act on the pole are generally equal around the circumference thereof, as in the case, for instance, of a lamp post or antenna mast. The cross-section of the profile may extend through a full 350°, although preferably about 300°.

Pole sections having the cross-sectional shapes

shown in Figures 6 and 7 and provided with horizontally disposed braces or ties are suitable for use in pole assemblies in which installation work is often undertaken. These sections will preferably have thicker walls than the sections shown in Figures 3-5, and can be adapted to different loading conditions more readily, by modifying the thickness and extension of the stiffening in flanges 16 welded to the sections.

Figures 10 and 11 illustrate the connecting device 24 between the two upper pole sections 22, 23 (Fig. 1, 2). The connecting device 24 is comprised of four vertical attachment plates 26 which are firmly welded in pairs to respective sections, and a plurality of bolt joints 25 with intermediate washers 27 for reducing the risk of frost damage, among other things. The longitudinally extending welds have been shown with diagonal dashes in the Figures. It will be noted that the pole sections are slightly displaced in relation to one another, so as to enable the pole to be readily assembled and collapsed, and also that the pole sections of these embodiments are simply bolted together. When the pole includes a plurality of pivotally mounted sections, for pole handling purposes, it is preferred to offset the pole sections alternately to the right and to the left.

Although the present invention has been illustrated with particular reference to the embodiments described it will be understood that the invention is not restricted hereto and that changes and modifications obvious to those skilled in this art can be made.

It will also be understood that the pole sections, for instance, may be welded together in the absence of attachment plates and bolt joints, and that sections of different cross-sectional shapes can be advantageously combined. Furthermore, the longitudinal sides of the pole need not necessarily be parallel with one another, meaning that the pole may have a conical configuration, for instance. It is essential, however, that dimensioning of the profiles and the profile measurements are such as to ensure that the pole will fulfil all current standards and that the modifications lie within the scope of the features characteristic of the invention.

Further examples of conceivable modifications include the choice of other configurations for the ties and attachment plates and other materials having similar properties for those materials stated herein. In other words, the invention is not restricted to the illustrated and described embodiments, since modifications can be made within the scope of the following claims.

Claims

1. A pole for supporting power cables, telephone lines, cable conveyors, antennas or for use as a portal post, lamp pole or the like, comprising a single open metal profile (1, 2, 3, 4, 5) said profile (1, 2, 3, 4, 5, 6, 7) having two legs (8, 9), a polygonal cross-sectional shape and a longitudinally extending symme-

try plane (11), whereby braces or ties (12) are arranged in the opening between surface parts, which are spaced substantially equidistant from the symmetry plane (11) and connected to the ends of said tie; and in that each profile (1, 2, 3, 4, 5, 6) is provided with two longitudinally extending, planar stiffening flanges (14, 15, 16) which are disposed generally symmetrically or symmetrically in relation to the symmetry plane (11) of the profile.

2. A pole according to Claim 1, **characterized** in that said surface parts are provided on the longitudinally extending corner edges (17) of each profile (1, 3, 6) from which respective flanges (14) extend.
3. A pole according to Claim 1, **characterized** in that said surface parts are provided on the longitudinally extending side-parts (18) of respective flanges (16).
4. A pole according to Claim 1, **characterized** in that said surface parts are provided on longitudinally extending side-parts (19) of respective legs (9).
5. A pole according to any one of the preceding claims, **characterized** in that the ties (12, 13) are mounted horizontally at stepping distances from one another.
6. A pole according to any one of the preceding claims, **characterized** in that the profile (1, 2, 4) has an open polygonal cross-section of generally truncated U-shaped or U-shaped extension.
7. A pole according to any one of claims 1-5, **characterized** in that the profile (3) has an open polygonal cross-section of generally arcuate extension which embraces an angle of up to 350°.
8. A pole according to any one of claims 1-5, **characterized** in that the profile (5) has a cross-section of generally truncated V-shaped or V-shaped extension.
9. A pole according to any one of the preceding claims, **characterized** in that the pole is divided into sections (21, 22, 23) which are mounted adjacent one another in the direction of the long axis of the pole.
10. A pole according to claim 9, **characterized** in that the top pole section (23) is inclined relative to the other pole sections (21, 23) at an angle of between 0° and 100°.
11. A pole according to claim 9 or 10, **characterized** in that at least two of the sections (22, 23) have mutually different cross-sectional shapes.
12. A pole according to any one of the preceding claims, **characterized** in that pivotal connectors (24) are

mounted between the pole and a pole supporting element or foundation (20) and/or between at least two pole sections (22,23) to provide a foldable pole assembly.

Patentansprüche

1. Mast zum Tragen von Stromkabeln, Telefonleitungen, Seilkreisförderern, Antennen oder zur Verwendung als ein Portalpfosten, Lichtmast oder dergleichen, mit einem einzigen offenen Metallprofil (1, 2, 3, 4, 5), wobei das Profil (1, 2, 3, 4, 5, 6, 7) zwei Schenkel (8, 9), eine polygonale Querschnittsform und eine sich in Längsrichtung erstreckende Symmetrieebene (11) aufweist, wodurch Streben oder Verbindungsteile (12) in der Öffnung zwischen den Oberflächenteilen angeordnet sind, die im wesentlichen in gleichem Abstand von der Symmetrieebene (11) beabstandet sind und mit den Enden des Verbindungsteils verbunden sind, und jedes Profil (1, 2, 3, 4, 5, 6) mit zwei sich in Längsrichtung erstreckenden, ebenen Versteifungsflanschen (14, 15, 16) versehen ist, die im allgemeinen symmetrisch oder symmetrisch relativ zu der Symmetrieebene (11) des Profils angeordnet sind.
2. Mast nach Anspruch 1, dadurch gekennzeichnet, daß die Oberflächenteile auf den sich in Längsrichtung erstreckenden Eckkanten (17) jedes Profils (1, 3, 6) vorgesehen sind, von denen aus sich die jeweiligen Flansche (14) erstrecken.
3. Mast nach Anspruch 1, dadurch gekennzeichnet, daß die Oberflächenteile auf den sich in Längsrichtung erstreckenden Seitenteilen (18) der jeweiligen Flansche (16) vorgesehen sind.
4. Mast nach Anspruch 1, dadurch gekennzeichnet, daß die Oberflächenteile auf sich in Längsrichtung erstreckenden Seitenteilen (19) der jeweiligen Schenkel (9) vorgesehen sind.
5. Mast nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Verbindungsteile (12, 13) horizontal in Stufenabständen voneinander angebracht sind.
6. Mast nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Profil (1, 2, 4) einen offenen polygonalen Querschnitt mit einer im allgemeinen abgestumpften U-Form oder eine U-förmige Ausdehnung aufweist.
7. Mast nach einem der Ansprüche 1-5, dadurch gekennzeichnet, daß das Profil (3) einen offenen polygonalen Querschnitt mit einer im allgemeinen bogenförmigen Ausdehnung aufweist, die einen Win-

kel von bis zu 350° umgreift.

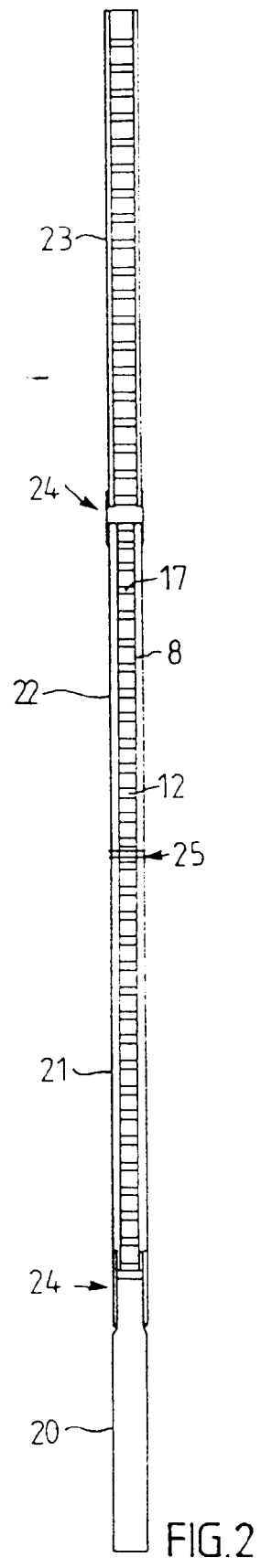
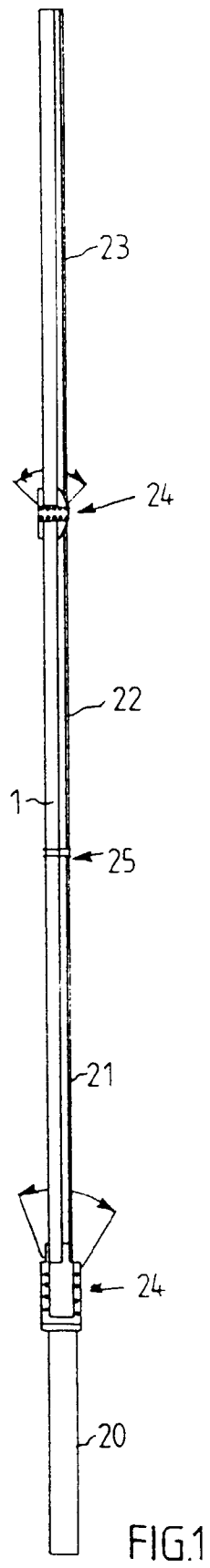
8. Mast nach einem der Ansprüche 1-5, dadurch gekennzeichnet, daß das Profil (5) einen Querschnitt mit einer im allgemeinen abgestumpften V-Form oder eine V-förmige Ausdehnung aufweist. 5
9. Mast nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Mast in Abschnitte (21, 22, 23) unterteilt ist, die in der Richtung der Längsachse des Mastes aneinander angrenzend angebracht sind. 10
10. Mast nach Anspruch 9, dadurch gekennzeichnet, daß der obere Mastabschnitt (23) relativ zu den anderen Mastabschnitten (21, 23) in einem Winkel geneigt ist, der zwischen 0° und 100° liegt. 15
11. Mast nach Anspruch 9 oder 10, dadurch gekennzeichnet, daß mindestens zwei der Abschnitte (22, 23) zueinander unterschiedliche Querschnittsformen aufweisen. 20
12. Mast nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die als Drehpunkt dienenden Verbindungsglieder (24) zwischen dem Mast und einem Maststützelement bzw. einer Mastbasis (20) und/oder zwischen mindestens zwei Mastabschnitten (22, 23) angeordnet sind, um eine zusammenklappbare Mastanordnung vorzusehen. 25 30

Revendications

1. Pylone destiné à supporter des câbles d'alimentation, des lignes de téléphone, des convoyeurs de câble, des antennes ou pour être utilisé en tant que pylone à portique, en tant que candélabre d'éclairage publique ou analogue, comprenant un simple profilé ouvert métallique (1, 2, 3, 4, 5), ledit profilé (1, 2, 3, 4, 5, 6, 7) possédant deux jambes (8, 9), une forme polygonale en coupe transversale et un plan de symétrie (11) s'étendant longitudinalement, des brides ou tirants (12) étant agencés dans l'ouverture entre des parties de surface, qui sont espacées sensiblement de manière équidistante à partir du plan de symétrie (11) et reliées aux extrémités dudit tirant ; et chaque profilé (1, 2, 3, 4, 5, 6) étant muni de deux rebords de raidissement (14, 15, 16) plans qui s'étendent longitudinalement et qui sont placés de manière générale symétrique ou symétriquement par rapport au plan de symétrie (11) dudit profilé. 40 45 50
2. Pylone selon la revendication 1, caractérisé en ce que lesdites parties de surface sont placées sur les bords d'angle (17), s'étendant longitudinalement, de chaque profilé (1, 3, 6) à partir desquels les re-

bords respectifs (14) s'étendent.

3. Pylone selon la revendication 1, caractérisé en ce que lesdites parties de surface sont placées sur les parties latérales (18), s'étendant longitudinalement, des rebords respectifs (16). 5
4. Pylone selon la revendication 1, caractérisé en ce que lesdites parties de surface sont placées sur des parties latérales (19), s'étendant longitudinalement, des jambes respectives (9). 10
5. Pylone selon l'une quelconque des revendications précédentes, caractérisé en ce que les tirants (12, 13) sont montés horizontalement à des distances d'échelonnement les uns des autres. 15
6. Pylone selon l'une quelconque des revendications précédentes, caractérisé en ce que le profilé (1, 2, 4) possède une section transversale ouverte polygonale de forme générale en U tronqué ou de forme en U. 20
7. Pylone selon l'une quelconque des revendications 1 à 5, caractérisé en ce que le profilé (3) possède une section transversale ouverte polygonale de forme générale courbe et s'étend sur un angle pouvant aller jusqu'à 350°. 25
8. Pylone selon l'une quelconque des revendications 1 à 5, caractérisé en ce que le profilé (5) possède une section transversale de forme générale en V tronqué ou de forme générale en V. 30
9. Pylone selon l'une quelconque des revendications précédentes, caractérisé en ce que le pylone est divisé en tronçons (21, 22, 23) qui sont montés voisins les uns des autres dans la direction du grand axe du pylone. 35 40
10. Pylone selon la revendication 9, caractérisé en ce que le tronçon (23) supérieur de pylone est incliné par rapport aux autres tronçons (21, 23) de pylone sous un angle compris entre 0° et 100°. 45
11. Pylone selon la revendication 9 ou 10, caractérisé en ce qu'au moins deux des tronçons (22, 23) possèdent des formes de section transversale mutuellement différentes. 50
12. Pylone selon l'une quelconque des revendications précédentes, caractérisé en ce que des organes de liaison (24) pouvant pivoter sont montés entre le pylone et un élément support de pylone ou fondation (20) et/ou entre au moins deux tronçons (22, 23) de pylone de manière à fournir un ensemble de pylone pouvant être plié. 55



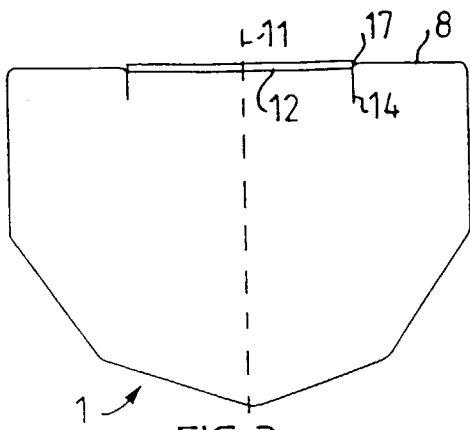


FIG. 3

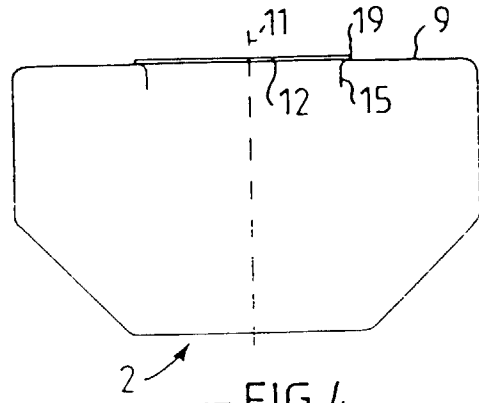


FIG. 4

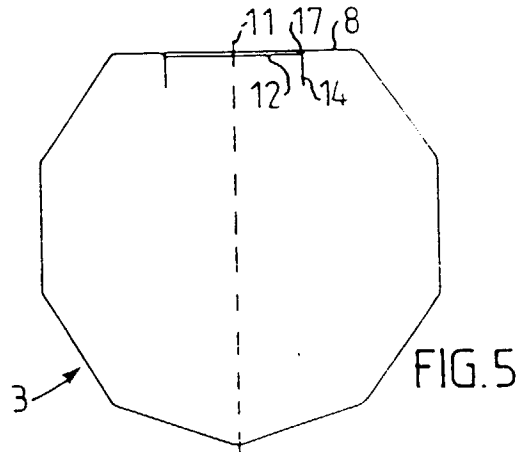


FIG. 5

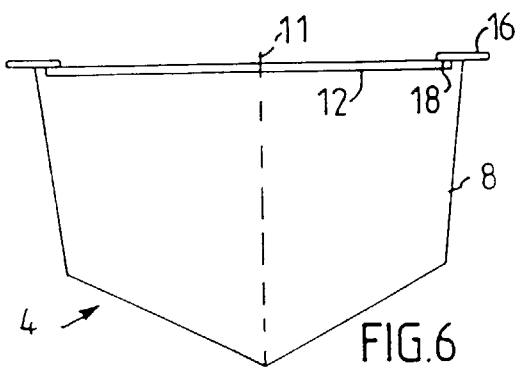


FIG. 6

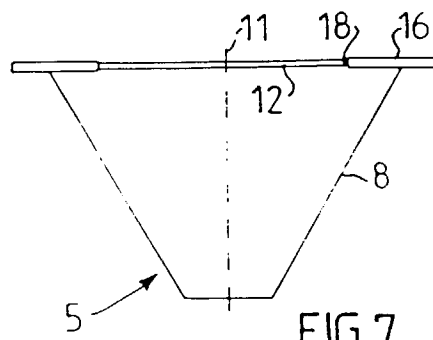


FIG. 7

