**Title:** IMPROVEMENTS RELATING TO SUPPORT STRUCTURES

**Abstract**

The basic support structure comprises upright struts (1) with main cable runs (2 and 3) which are connected at their cross-over points to a common bracing member (5). Guying cables (4) are provided to hold the structure in the upright position. Additional support cables are provided above and below the main cables (2 and 3) and further cable runs are positioned adjacent to the guying cables (4). Covering material can be positioned over all of these cables at the regions A, B, C and D illustrated. In a particular arrangement the covering material on cables at A will comprise mesh netting or flexible fabric or rigid panels permanently fixed into position. Where flexible fabric or netting is provided, means can be incorporated to enable the material to be open or closed as required. Mesh netting could be formed from strong wire mesh to provide protection against items which might fall on to the structure. An all-weather fabric (mainly for rain protection) can be provided in the regions indicated at B. Again this can be flexible material which can be opened or closed, depending upon the existing climatic conditions. Fire-resistant material could also be supplied here. At regions C and D further all-weather fabric or shade protection material could be provided and the cable runs at D could also carry overhead sprinklers such as might be used in greenhouses. The main support cables (2, 3 and 4) at B and C may be in the form of tubing for small structures, but for very large structures wire rope would generally be required.
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"Improvements relating to Support Structures"

This invention is concerned with structures which are capable of supporting protective covers. There is a need for such structures to enable large areas to be covered. Examples are a sports stadium, a marquee, or an exhibition complex. Such structures may be required temporarily, or on a permanent basis, but with the capability of enabling the cover to be withdrawn, depending upon weather conditions. In many instances, where such structures would be desirable, the cost of materials and assembly are generally prohibitive.

It is an object of this invention to provide a form of support structure which is sturdy in design and yet can be produced and erected at a reasonable cost, and which provides the facility for the support of a cover which can be withdrawn when conditions allow.

According to the invention, from one aspect, there is provided a support structure comprising a straight or curved linear array or other predetermined array of pairs of substantially upright struts, two cable runs attached at vertically spaced positions to the top portions of each pair of struts and projecting diagonally so that the cable runs cross over at a point approximately mid-way between the struts, a common rigid bracing member interconnected at the cross-over points to the cable runs of the various pairs of struts, and guying members for bracing the struts in the substantially upright condition.

From a further aspect there is provided, in accordance with the invention, a support structure comprising a straight or curved linear array or other predetermined array of substantially upright struts, two cable runs attached at vertically spaced positions to
the top portion of each strut and projecting down to a common fixing point for attachment to an existing wall structure, and a common rigid bracing member interconnected to the common fixing points of the cable runs of the various pairs of struts, and guying members for bracing the struts in the substantially upright condition.

The guying members can comprise guying cables leading down to a ground fixing point. Alternatively or additionally the guying members can comprise rigid struts interconnected between the respective pairs of upright struts near to their top ends, ideally below or at the lower fixing points of the pair of cable runs of the struts.

It is to be appreciated that the objective of the invention is achieved not only by the use of conventional cables (for example wire rope) for the cable runs, but also by substantially rigid linkage members which could be of hollow or solid construction. Tubular steel struts would be particularly suitable for this purpose. Furthermore, the guying cables could also be replaced by substantially rigid members of a similar nature.

A further modification provides that the guying cables could be replaced by or augmented with rigid rods (of any suitable cross-section) interconnected between the upright struts, near to their top ends. This arrangement would be particularly suitable where the support structure is to be erected over the flat roof of a building, so that the struts are near to the edges of the roof, in which case no supporting points would be available for any guying cables. Ideally the rigid rods would be positioned below or at the lower fixing points of the pair of cable runs to the struts, so as to be horizontal to the floor of the area being covered.
An additional feature which might be incorporated into the support structure is the provision of end wall portions (at the two ends of the common rigid bracing member) which will have a horizontal top surface and will provide added rigidity at these ends as well as additional support for the bracing member. This would alleviate the possibility of the structure being pulled towards the centre.

In the most straightforward arrangement the struts will generally be aligned in a straight or curved linear array. In this instance the bracing member may comprise a bar or tube, and ideally a gutter channel member will be positioned below the bracing member, to collect rainwater from any covering material over the structure. This gutter channel member may be suspended from the cables of the cable runs, or from the bracing member.

In an alternative arrangement the struts could be aligned in an oval or circular array, in which case the bracing member is ideally also of oval or annular form. This bracing member can incorporate a central opening leading to a water collecting pipe or trough.

Each cable run of the structure may be in two sections, interconnected by a common linkage member for the two cable runs at the cross-over point. Thus the linkage members could be secured to the bracing member. Alternatively, the cable runs could pass through passageways in a bracket attached to the bracing member. This allows the two cable runs to be provided by one continuous cable passing over pulleys at the attachments to the struts and leading to a winding mechanism, which could allow for tensioning of the cables, or displacement of the cables to move any covering material connected thereto.

Additional strengthening cables could be connected to the struts directly between the upper and/or lower
pairs of cable attachments. There could also be additional lattice-type strengthening members between the cable runs and/or between adjacent struts of one set of the pairs of struts. The support structure will advantageously include a cover member supported by the cable runs. This cover member will preferably comprise a main waterproof cover on the upper portions of the cable runs. A subsidiary mesh cover could be carried by the lower portions of the cable runs. There may also be side cover members supported on the guying cables. In one arrangement the cover members are flexible, and preferably there will be a mounting arrangement for the cover which enables the cover to be drawn to and from the covering position. Alternatively the cover members may be of rigid form, and could then be corrugated in shape.

The cover is advantageously provided in sections which overlap at their adjoining edges.

A tower structure of generally tapering form may be provided to project upwardly above one or more of the struts.

For ease of installation the struts may be provided on pivotal base mountings and will be aligned to allow the whole structure to be raised or lowered in one operation.

The lower cable runs of the structure may carry lighting units or other utilities.

The invention may be performed in various ways and preferred embodiments thereof will now be described with reference to the accompanying drawings, which illustrate a variety of designs of support structure of this invention and particular features thereof.

A basic support structure is illustrated in Figure 1 and comprises a collection of upright struts 1 inter-connected by diagonal cables 2, 3 and held in place by
guying cables 4. Each cable 2 or 3 is attached at one end to the top of one of the pair of struts 1 and at the other end to a lower point on the other of the pair of struts. At the points where each pair of cables 2 and 3 cross-over they are interconnected by a rigid bar or tube 5 which stabilises the structure.

Referring now to Figure 2A, there is shown the same support structure as shown in Figure 1 but covered by flexible sheets which provide roof covering panels 6, 7, front and rear edging strips 8 and side panels 9. These panels lie over the cables 2, 3 and the guys 4. At the ridge points where the roof panels 6 and 7 meet, an angled covering strip 10 is provided. At the valleys where the roof panels 6 and 7 meet a trough 11 is provided to collect rainwater which will be led away to a downpipe (not shown). A more elaborate method of covering the support structure is shown in Figure 2B. The side panels 9, for example, incorporate sections which are openable by raising or lowering a strip 12 or 13 to which a flexible sheet 14 in the form of a curtain is attached. A similar arrangement can be provided for the roof panels where individual strips of material 15 are interconnected between the ridge strips 10 and valley strips 16. By this means ventilation may be improved, depending upon weather conditions and, of course, the roof panels can be drawn back completely to allow natural light in when the weather is fair.

Figures 1 and 2B also illustrate lattice-type strengthening structures 17 interconnecting each run of struts 1.

There are a number of ways of inter-connecting the struts 1. For example Figure 3A shows the simplest method of interconnecting each pair of struts by means of the cables 2, 3 and the guys 4. Figure 3B incorporates additional horizontal cables 18 and further guys
19 leading from the lower connecting point for the main 
cables 2, 3. Figure 3C shows how a number of runs of 
struts 1 may be interconnected by means of the cables 2, 
3, with the outer struts being supported by guys 4 and 
19. Height variation may be achieved as illustrated in 
Figure 3D where mainstruts 1 are interconnected to shor-
ter struts 1A by cables 2A, 3A and additional support 
cables 20. This Figure also shows more clearly a water 
collection trough 11 which is supported by wires 22 
attached to a main cable 2, and is connected to a down-
pipe 21.

Tension adjustment members may be incorporated. 
Thus tension adjusters 23, 24, Figure 4A, may be connec-
ted between guys 4 and 19 and between the cables 2 and 3 
respectively. As an alternative a ground level tension 
adjuster 25 could be connected to the guys 4 and 19 as 
shown in Figure 4B. Figures 4C and 4D respectively 
illustrate use of tension adjusters 23 or of the tension 
adjusters 24 only.

As shown in Figure 5A, additional cables 26 may be 
attached to the main cables 2 and 3 to hold these cables 
downwardly. Figure 5B illustrates, in plan view, the 
provision of further cables 27 running from the corners, 
defined by runs of the struts 1 to central positions 
onto a bracing member 5. Figure 5C further shows the 
disposition of the auxiliary cables 26 and 27.

The cables 2 and 3 need not necessarily extend 
continuously, but each may be in two parts interconnec-
ted in the region where they cross-over. The inter-
connecting member may then provide a mounting for the 
bracing member 5 and for the trough 11. This is illustr-
ated, for example, in Figure 6A by the provision of 
an interconnecting member 28. A bracket 29 grips the 
bracing member 5. These various features are shown 
additionally in Figures 6B and 6C.
A number of various alternative methods of interconnecting the cables 2 and 3 with the bracing member 5 are illustrated. Thus in Figures 7A, 7B and 7C a special bracket 30 locks together the bracing member 5 with the cables 2 and 3 by means of a gripping plate 31. In the arrangement shown in Figures 7D and 7E a special plate 32 with angled portions provides mounting points for special connectors 33 on the ends of the cables 2 and 3 and the plate 32 is attached to the bracing member 5 by a bolt 34 passing therethrough. A slightly different method of interconnecting the plate 32 with the bracing member 5 is shown in Figures 7F, 7G and 7H where a special bracket 35 is provided which is mounted over the bracing member 5 and is held there by bolts 36 and angled washers 37.

Various other methods of interconnecting cables to bracing members in the form of tubes, or for interconnecting one tube to another or for inter-linking cables which cross-over one another, are clearly illustrated in the various drawings in Figure 8.

As part of an alternative method of linking the cables 2 and 3 to the bracing member 5, there is illustrated firstly in Figures 9A to 9E, in various views, a bracket 38 formed, for example, from a plastics material which can be located over the bracing member 5 and then flexed from the condition shown in Figure 9B to a closed state where it grips around the bracing member 5, being held there by a bolt 39. The bracket 38 has a pair of through-passageways 40 and the cables 2 and 3 are threaded through these passageways. An alternative form of bracket 41 incorporating through-passageways 40 is illustrated in Figures 9F to 9I. This bracket sits below the bracing member 5 and is held in place by a bolt 42 which passes through the bracing member 5. Because the cables 2 and 3 pass freely through the
passageways 40, the position of the cables may be modified as illustrated in Figure 9J. This shows that, in this instance, the cables 2 and 3 are part of a single run passing around pulleys 43 and wound around a drum 44. A pulley 45 connected to the drum 44 is linked by a belt or cable 46 to a further pulley 47 provided with a handle 48. Thus by winding the handle 48 the cables 2 and 3 can be made to move in the directions illustrated by the arrows 49. Then any flexible covering attached to the upper runs of the cables 2 and 3 will be drawn back at the same time towards the struts 1 (and vice versa). It will be appreciated that the ends of the continuous cable run defining the cables 2 and 3 could be led to a tensioning device to provide a means of achieving the required tension in the cables (as an alternative to adjusting the positions of the cable runs as illustrated in Figure 9J).

A number of methods may be employed for applying a covering material to the support structure. Thus, for example, as shown on the right-hand side of Figure 10A a flexible sheet 50 could be attached to the upper run of the cable 3 and to the guy 4. A second flexible layer could additionally be provided on the guy 19 and the lower run of the cables 2, 3. Alternatively as shown in Figure 9B, rigid cladding panels 51 could be provided on the outer runs of the cables and guys with, if desired, additional flexible covering 52 on the lower runs of the cables and guys. Figure 10C illustrates rigid panels 53 carried by the guys 4 only, with flexible coverings 54 and 55 carried by the cable runs 2 and 3. In Figure 10D rigid panels 56 are provided on the upper runs only of the cables 2 and 3, whilst flexible sheets are provided elsewhere. Other variations of rigid panels and flexible sheets are of course possible.

Flexible sheeting may be used to cover the support
structure and various forms of sheeting are shown in Figure 11B. These are carried by rings 57 clipped onto the main cables 2 and 3 and auxiliary horizontal cables 18. The mounting of the flexible sheet onto the cables by the rings 57 enables them to be drawn from a closed condition shown on the left-hand side of Figure 11A to the open condition illustrated on the right-hand side of Figure 11A. If multiple layers are provided, as shown in Figure 11B, then these may be drawn selectively to provide covering suitable for varying conditions. In this instance the top layer 58 could be just a means of providing shade from the extremes of sunlight and/or could be in the form of a wire or plastics mesh giving a certain amount of protection. The main sheeting 59 would be robust so as to provide all weather protection. The layer 60 is shown as a wire of plastics mesh. Finally, the lower layer 61 could provide shade and/or insulation.

Figures 12A and 12B show similarly how sheeting may be mounted on the guys 4 and 19 by means of the rings 57 so as to hang down from the top ends of the guys. Again these sheets can be slid up and down between fully withdrawn and fully closed positions, as required. The upper sheet 62 would provide all weather protection whilst the lower sheet 63 can be designed to provide full or partial shade.

Figures 13A to 13J illustrate various ways of integrating rigid panels and flexible sheets carried, for example, by a guy 4 and to provide overlapping of the various covering materials as necessary. In Figure 13A, for example, a flexible sheet 64 is provided on the outside of the guy 4 in the upper region, whilst a further flexible sheet 65 is provided on the inner side of the guy 4 in the lower region, and a rigid connector piece 66 is attached to the guy to provide overlap of
the two flexible sheets. In Figure 13B the connector piece 66 overlaps rigid panels 67 attached to the guy 4. Variations on this general theme are illustrated in Figures 13C to 13F and more intricate combinations are shown in Figures 13G and 13H. In all these arrangements it will be appreciated that the flexible sheets 64 and 65 are capable of being raised or lowered to provide ventilation etc. Drainage systems are indicated in Figures 13I and 13J. Thus, for example, the end of a flexible sheet 64 may be tied back to form a loop which supports a tube 68 which is riddled with holes so that rainwater running down the sheet 64 will collect into the tube 68 and will run off to the ends where the tube can be connected to a downpipe. Where the covering terminates in a rigid panel 67 (Figure 13J) a conventional gutter channel 69 can be supported on the guy 4.

Figure 14 illustrates the supporting of separate panels in the form of flexible sheets by means of the upper runs of the cables 2 and 3. Where edges of these panels meet, there should desirably be some form of overlapping arrangement such as that shown in Figure 14B, where an overlap strip 70 is carried by a pair of additional cables 71 leading down to the bracing member 5. There will also be a collecting channel 72 positioned below to catch any rainwater which might spill over the edges of the main panels 73 and 74, particularly at times when the sheets are being drawn back. The channel 72 will of course lead down to the main gutter trough 11 (Figure 14D). Any water which happens to fall on sheets 75 carried by the lower runs of the cables 2 and 3 (see Figure 14C) could be collected by a downpipe arrangement 76.

Figure 15 illustrates further types of water collection constructions, particularly for the collection of water which falls onto the sheeting 75 which may be
mounted on the lower runs of the cables 2 and 3. In this case gutter channels 77 are supported by the struts 1 and lead to downpipes 78. The outer portion 79 of the flexible covering may incorporate sleeving 80 which leads part of the way up a strut 1.

Figure 16 illustrates more detailed features of the integration of the various parts of a total covered support structure as described with reference to the previous drawings. A particular additional feature is the provision of a mounting strip 81 to which ends of the cable runs 2 and 3 and the inner end of a flexible covering sheet 82 will be attached. Then when the cable runs are displaced (by means of the mechanism illustrated in Figure 9J) the cover 82 will be drawn back as shown particularly in Figure 16A.

Figures 17A and 17B illustrate the provision of small wheels 83 which provide a modified configuration for the inner edge of a flexible covering sheet 84 to assist in the direction of water into the gutter trough 11. This trough may be formed from metal and/or a flexible material. If, as shown in Figures 17C and 17D, the gutter trough is formed from a flexible sheet 85, rigid spreaders 86 may be provided at intervals to retain the desired shape of the trough.

Figures 17E and 17F show how rigid corrugated cladding sheets 87 may be mounted onto the support structure by means of hook bolts 88 fixed onto auxiliary rods or tubes 89.

Figure 18 illustrates how a section of a support structure may be assembled for installation in a single operation. The struts 1 are provided with pivotal support members 90 at their lower ends which will be secured to the ground with the struts 1 lying on the ground. The cables 2 and 3, guys 4 and 19, bracing member 5 and the gutter trough 11, may then be inter-
connected at ground level. Finally, the whole assembly would be raised in a single operation by operating winches 91, acting on cables 92 which are led over temporary vertical struts 93 to be attached to the upper portions of struts 1 at the ends of the structure. Once the whole assembly is raised the end-supporting guys 94 can be secured to their ground attachment points 95 and any necessary tensioning of the whole assembly can be carried out before dismantling the temporary struts 93 and removing the cables 92.

A modified form of support structure is illustrated in Figure 19. This is of circular rather than rectilinear form, with the pairs of struts 1 being positioned diametrically opposite to one another. All the cable runs 2 and 3 would then lead down to a common central point where they would be attached to a single circular bracing member 96. The central portion of the bracing member 96 will form a throat leading to a downpipe through which collected rainwater may be led away.

An alternative form of central bracing member is shown in Figure 20. This has a modified central throat member 99 provided with eyes 100 to which the ends of flexible covering sheets 101 may be attached. A similar central bracing member 102 is illustrated in Figure 20C for use with rigid cladding sheets 103 (which would be triangular in plan view). Again a water collection throat member is provided.

Various decorative structures may be incorporated within the support structure such as the tower arrangement 104 shown in Figure 21. This can additionally act as a ventilation tower and will be clad with rigid or flexible covering panels which will be integrated with the covering panels of the main structure.

Figure 22A illustrates the provision of rigid cross-rods 105 which support the upright struts 1 in a
vertical position and could allow for the omission of
the guying members 4. Both the rods 105 and (where
present) the guying cables 4 could be constructed from
tubular steel section or any other suitable rigid
member. Figure 22B illustrates a substantial structure
wherein the guying cables are omitted and the vertical
struts 1 are supported in the vertical condition by an
additional rigid rod 105.

Figure 23A illustrates an arrangement where the
support structure has been mounted at the edges of a
flat roof space. In this case no guying cables are
provided, but additional support for the upright struts
1 is provided by rigid cross-ribs 105. Also the side
walls are formed by hinged panels 106 which can, for
example, be moved to an alternative position 106A
providing a platform supported by a barrier portion 107
when it is desired to open up the roof area to the
elements. Figure 23B illustrates arrangements whereby
such a support structure could be added to an existing
roof. Figures 24A, B and C illustrate the means
whereby the panels 106 are hinged together and how they
can be collapsed down in stages (as required) to provide
an opening of a desired size.

Figures 25A and 25B illustrate the provision of an
upright wall portion 108 at the two ends of a support
structure. As can be seen from Figure 25B these wall
portions are formed in a lattice-type array 109
providing descending angled support portions 110 for the
ends of the roof covering.

Figure 26A illustrates a modified method of inter-
connecting the cable runs which, in this case, are solid
bars 111 and 112 (or tubular rod members). These can be
used on smaller structures and for those will provide a
more rigid interconnection. The cable runs 111 and 112
in this instance are interconnected together as shown
and provide support for the water collection trough 11. Another modified arrangement is shown in Figure 26B where the interconnecting member 113 is shaped to receive the water collection trough 11 and also provides fixing points for rigid bars or tubes which define the cable runs 111 and 112. With both these arrangements (shown in Figures 26A and 26B) covering members such as sheeting 114 or rigid panels 115 may be supported.

Figure 27A illustrates a modified support structure which can be mounted against the wall 116 of an existing building. In this instance rigid rods or tubes define cable runs 111 and 112 which are attached to parts of a modified connecting member 117 which will be fixed to the wall 116. This design is shown in more detail in Figure 27B. The other ends of the cable runs 111 and 112 are attached to respective upright struts 1. The overall design of the support structure shown in Figure 27A may take many forms and may incorporate features, as shown in other Figures, in the self-supporting support structures.

Figure 28 illustrates many of the features of the standard support structures as shown in the previous Figures. The basic structure comprises upright struts 1 with main cable runs 2 and 3 which are connected at their cross-over points to a common bracing member 5. Guying cables 4 are provided to hold the structure in the upright position. Additional support cables are provided above and below the main cables 2 and 3 and further cable runs are positioned adjacent to the guying cables 4. Covering material can be positioned over all of these cables at the regions A, B, C and D illustrated. In a particular arrangement the covering material on cables at A will comprise mesh netting or flexible fabric or rigid panels permanently fixed into position. Where flexible fabric or netting is provided,
means can be incorporated to enable the material to be open or closed as required. Mesh netting could be formed from strong wire mesh to provide protection against items which might fall on to the structure. An all-weather fabric (mainly for rain protection) can be provided in the regions indicated at B. Again this can be flexible material which can be opened or closed, depending upon the existing climatic conditions. Fire-resistant material could also be supplied here. At regions C and D further all-weather fabric or shade protection material could be provided and the cable runs at D could also carry overhead sprinklers such as might be used in greenhouses. The main support cables 2, 3 and 4 at B and C may be in the form of tubing for small structures, but for very large structures wire rope would generally be required.
1. A support structure comprising a straight or curved linear array or other predetermined array of pairs of substantially upright struts, two cable runs attached at vertically spaced positions to the top portions of each pair of struts and projecting diagonally so that the cable runs cross over at a point approximately mid-way between the struts, a common rigid bracing member interconnected at the cross-over points to the cable runs of the various pairs of struts, and guying members for bracing the struts in the substantially upright condition.

2. A support structure according to claim 1, wherein each cable run is in two sections interconnected by a common linkage member for the two cable runs at the cross-over point, the linkage members ideally being secured to the bracing member, or wherein the cable runs pass through passageways in a bracket attached to the bracing member, the two cable runs ideally being provided by one continuous cable passing over pulleys at the attachments to the struts and leading to a winding mechanism.

3. A support structure comprising a straight or curved linear array or other predetermined array of substantially upright struts, two cable runs attached at vertically spaced positions to the top portion of each strut and projecting down to a common fixing point for attachment to a existing wall structure, and a common rigid bracing member interconnected to the common fixing points of the cable runs of the various pairs of struts, and guying members for bracing the struts in the substantially upright condition.

4. A support structure according to any one of claims 1 to 3, wherein the bracing member comprises a bar or tube and ideally a gutter channel member is
positioned below the bracing member, preferably suspended from the cables of the cable runs or from the bracing member.

5. A support structure according to any one of claims 1 to 3, wherein the struts are aligned in an oval or circular array, the bracing member ideally also being of oval or annular form, preferably with a central opening leading to a water collecting pipe or trough.

6. A support structure according to any one of claims 1 to 5, including additional strengthening cables connected to the struts directly between the upper and/or lower pairs of cable attachments, and/or additional lattice-type strengthening members between the cable runs and/or adjacent struts of one set of the pairs of struts.

7. A support structure according to any one of claims 1 to 6, wherein the guying members comprise guying cables leading down to a ground fixing point and/or rigid struts interconnected between the respective pairs of upright struts near to their top ends, ideally below or at the lower fixing points of the pairs of cable runs to the struts.

8. A support structure according to any one of claims 1 to 7, including a cover member supported by the cable runs, which may be in the form of a main waterproof cover on the upper portions of the cable runs, with the optional addition of a subsidiary mesh cover on the lower portions of the cable runs, possibly with side cover members supported down the sides of the structure, the cover members preferably being flexible, or in the form of a hinged collapsible panel structure, ideally with a mounting arrangement for the cover which enables the cover to be drawn to and from the covering position, or being of rigid form, possibly of corrugated shape, the cover optionally being provided in sections
which overlap at their adjoining edges.

9. A support structure according to any one of claims 1 to 8, including other features such as being in the form of a tower structure of generally tapering form projecting upwardly above one or more of the struts, and/or wherein the struts are provided on pivotal base mountings and are aligned to allow the whole structure to be raised or lowered in one operation, and/or the lower cable runs carry lighting units or other utilities.
Fig. 4A

Fig. 4B

Fig. 4C

Fig. 4D

SUBSTITUTE SHEET
**INTERNATIONAL SEARCH REPORT**

**International Application No.** PCT/GB 88/01020

### I. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both National Classification and IPC

**IPC**

E 04 B 7/14

### II. FIELDS SEARCHED

**Minimum Documentation Searched**

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Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in the Fields Searched

### III. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Category</th>
<th>Citation of Document, with indication, where appropriate, of the relevant passages</th>
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<td>DE, A, 1955416 (MOLLINGER) 13 May 1971 see page 7, line 23 - page 8, line 2; figure 8</td>
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**IV. CERTIFICATION**

Date of the Actual Completion of the International Search:
23rd January 1989

Date of Mailing of this International Search Report:
10.02.89

International Searching Authority:
EUROPEAN PATENT OFFICE

Signature of Authorized Officer:

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Form PCT/ISA/210 (second sheet) (January 1985)
This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 03/02/89. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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For more details about this annex: see Official Journal of the European Patent Office, No. 12/82.