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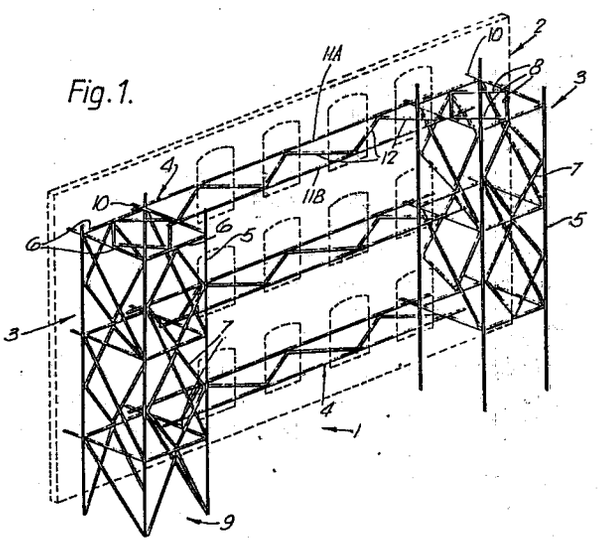
(54) A support system.

(57) There is disclosed an elongate channel section (15) intended for use as a component of a support structure which is intended to support a region or regions of a building or to support cladding, the channel section (15) comprising a planar base (16), two spaced-apart side walls (17) extending generally perpendicularly with regard to the plane of the base (17), and two short returns (18), each extending inwardly from the free end of a respective side wall (17), the base (16) being provided along its length with a series of regularly spaced pairs of apertures (20, 21) and each side wall (17) being provided along its length with a series of similarly regularly spaced apertures (23). The section (15), in combination with other components, may be used to construct a support structure for supporting a region or regions of a building, such as a facade of a building.

Fig. 1.



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Description

A SUPPORT SYSTEM

This invention generally relates to a support system intend for use in retaining regions of a building which might otherwise collapse. In particular, the present invention is concerned with the individual components of the support system, which components may be simply and quickly assembled into a support structure by the use of conventional fixing means. The support structure can easily be dismantled and the components re-used.

An existing facade support comprises a series of vertical towers interconnected by means of horizontal trusses, which in turn are secured to the facade. The towers and the trusses are welded together to provide a facade support which has sufficient structural integrity to perform its supporting function. Such a facade support is time-consuming to construct and dismantle and the material from which the known facade support is made is not generally re-usable.

According to a first aspect of the present invention there is provided an elongate channel section intended for use as a component of a support structure which is intended to support a region or regions of a building, the channel section comprising a planar base, two spaced-apart side walls extending generally perpendicularly with regard to the plane of the base, and two short returns, each extending inwardly from the free end of a respective side wall, the base being provided along its length with a series of regularly spaced pairs of apertures and each side wall being provided along its length with a series of similarly regularly spaced apertures.

In the channel section of the first aspect of the present invention, it is preferred that respective pairs of apertures in the base are aligned across the width of the base with one aperture of each pair being on one side of the base, a predetermined distance from the centre line of the base, and with the other aperture of each pair being on the other side of the base the same predetermined distance from the said centre line.

Moreover, it is preferred that the distance between adjacent apertures on the one side of the base or the distance between adjacent apertures on the other side of the base is greater than the distance between each aperture of a respective pair of apertures.

In addition, in a preferred embodiment of the first aspect of the present invention, each aperture of the side walls is aligned with a respective pair of apertures in the base. Moreover, the apertures of each series of apertures provided on the side walls are preferably disposed on a line parallel to the length of the section.

The perpendicular distance from each aperture in a side wall to the plane of the base may conveniently be less, preferably only slightly less, than half the distance between a pair of apertures in the base.

Although the spaced-apart side walls may be connected directly to the base, in a preferred embodiment of the channel section according to the first aspect of this invention, each side wall is connected to the base by a strip which is inclined to the base and a respective side wall.

The elongate channel section is preferably made from 6mm mild steel which may be pressed or cold rolled into the appropriate channel shape. The apertures may be punched under control of a computerised puncher.

According to a second aspect of the present invention, there is provided an elongate unit comprising two identical or substantially identical elongate channel sections in accordance with the first aspect of the present invention, the two sections being secured together and arranged base-to-base such that the channels of each section face in opposite directions and corresponding side walls of the two sections lie in the same plane, the two sections being spaced-apart such that the perpendicular distance between the series of apertures in one side wall of one section and the series of apertures in the co-planar side wall of the other section is equal to the spacing between adjacent pairs of apertures in the base of either elongate channel section.

The two elongate channel sections from which the elongate unit of the second aspect of the present invention is constructed may include any one or more of the features described above with reference to the channel section of the first aspect of this invention.

According to a third aspect of the present invention, there is provided a tower of square or other rectangular cross-section, having four legs defining the corners of the square or other rectangle, each leg being an elongate unit in accordance with the second aspect of the present invention and adjacent legs being connected at intervals along the height of the tower by a plurality of rigid connecting members.

Each of the rigid connecting members may be an elongate channel section in accordance with the first aspect of the present invention or, alternatively, an elongate unit in accordance with the second aspect of the present invention. The legs may also be connected together by tubular connecting members.

According to a fourth aspect of the present invention, there is provided a truss comprising two parallel, spaced-apart elongate units in accordance with the second aspect of the present invention, one of the two elongate units being orientated about its length by 90° relative to the other of the two elongate units, the two elongate units being secured with respect to each other by a plurality of connecting means.

An alternative truss, which constitutes a fifth aspect of the present invention, may comprise an elongate unit in accordance with the second aspect of the present invention and, parallel to and spaced from the elongate unit, a channel section in

accordance with the first aspect of the present invention, one of the elongate unit and channel section being oriented about its length by 90° relative to the other of the elongate unit and channel section, the elongate unit and channel section being secured with respect to each other by a plurality of connecting means.

The truss may be replaced by a wailing comprising a single elongate unit in accordance with the second aspect of this invention. The two sections of the unit may be spaced about 26mm apart by spacers.

Preferably, the connecting means employed in the fourth or fifth aspect of the present invention may be inclined to the length of the elongate units/channel section of the truss.

According to a sixth aspect of the present invention there is provided a method of supporting the facade of a building comprising:

(i) erecting at least two towers, each in accordance with the third aspect of the present invention, a predetermined distance from the facade;

(ii) securing at least one horizontal truss in accordance with the fourth or fifth aspect of the present invention between the at least two towers such that an elongate unit or a channel section of the truss lies close to and parallel to the facade; and

(iii) securing the truss to the facade by means of a plurality of fixing means.

The method according to the sixth aspect of the present invention enables a facade support to be quickly and simply constructed in situ from a small number of basic units. The facade support may be constructed on the inside or the outside of the facade, whichever is preferred. Once the facade has been permanently supported or repaired, for example by an internal permanent structure being built, the facade support produced in the method of the sixth aspect of the present invention may be dismantled into its component parts. If the support structure has not been in situ for very long, the components may be used again immediately. If, however, the facade support has been in place for a longer period of time, for example, two years, the individual components, or at least the majority of them, may be cleaned and re-painted, ready for re-use.

It is believed that, by the use of such a structure which can be dismantled and re-used, savings of at least 20% when new may be made which may rise to 60% on second and further uses. In addition, it is envisaged that the time between the preparation of suitable drawings for construction of a large support structure to the "on-site" day could be reduced to as little as four weeks.

It is envisaged that the facade support which may be constructed using the components of this invention may be up to 30 metres high or even higher still.

Although the present invention has been particularly described with regard to retaining a facade of a building, it is to be appreciated that the present invention is not limited to such an application. Thus, the present invention provides basic constructional elements together with a basic technique by which buildings may be shored. Thus, for instance, the basic constructional units of the present invention may be used to assemble a dead-shoring for supporting a wall over an opening. In this instance, a tower, as is required in a facade retaining structure, may not be needed. A jack may be used in some of the dead-shoring applications.

In addition, the constructional elements may be used to construct a flying shore. Such a shore is often used when pulling down a single unit of a terrace, whilst leaving the remaining units standing. The flying shore spans the party walls which are to remain.

Furthermore, the present technique may be used to provide a raking shore which might be required to support, for instance, a free standing wall. A raking shore would comprise a series of inclined struts leading to, for example, one or more trusses or wailings, which would support the free standing wall.

The support structure of the present invention is intended to support a region or regions of a building. Usually, the regions supported will be existing walls and roofs. However, the support structure may be employed as a framework in the construction of a permanent or semi-permanent building, for instance in the construction of, for example, a hanger, warehouse or shed. Thus, for instance, cladding panels of, for example, a natural or synthetic material may be secured to the support structure and, at their periphery, to each other to create a continuous covering which constitutes the "skin" of a building. The "skin" or cladding may be either to the outside or the inside of the support structure.

However, the examples given above are merely by way of example. The constructional units may be used in a multitude of different applications to replace existing constructional techniques in which the individual constructional elements are required to be purpose made and are, therefore, not re-usable.

For a better understanding of the present invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 shows a facade being supported by a facade-retaining structure produced in accordance with the present invention;

Figure 2 shows an elongate channel section in accordance with the first aspect of the present invention;

Figure 3 shows an elongate unit in accordance with the second aspect of the present invention;

Figures 4 to 6 shows a tower in accordance with the third aspect of the present invention;

Figures 7 to 9 show a truss in accordance with the fourth aspect of the present invention;

Figures 10 to 11A show details of the trusses as shown in Figures 7 to 9;

Figures 12 and 13 show Detail C of Figure 5;

Figures 14 and 15 show Detail D of Figure 4;

Figures 16 and 17 show Detail E of Figure 4;

Figures 18 and 19 show Detail F of Figure 6;

Figures 20 to 22 show Detail G of Figure 4;

Figures 23 to 26 show two types of gusset plate used in the present invention;

Figures 27 to 32 show two types of integral tubular connecting member having an end plate for use in the present invention;

Figures 33 and 34 show a packer element for use in the present invention;

Figures 35 to 38 show two types of splice plate for use in the present invention;

Figures 39 and 40 show a connector plate for use in the present invention;

Figures 41 and 42 show a tubular connecting member having an end plate for use in the present invention;

Figures 43 and 44 show another connector plate for use in the present invention;

Figures 45 and 46 show another type of packer for use in the present invention;

Figures 47, 48, 51, 52, 55 and 56 show various types of tubular connector member each having an integral end plate, for use in the present invention;

Figures 49, 50, 53 and 54 show two types of end plates for use in the present invention;

Figures 57 and 58 show another type of splice plate for use in the present invention;

Figures 59 to 62 show two types of base plate for use in the present invention;

Figures 63 to 74 illustrate the splicing together of horizontal elements of a truss;

Figures 75 and 76 illustrate arrangements of the rear boom member;

Figure 77 shows an inclined member of a truss or tower having different end plates at respective ends thereof;

Figures 78 and 79 show two further components useful in putting the present invention into effect;

Figures 80 and 81 show an alternative arrangement for joining two elongate sections back-to-back; and

Figures 82 to 85 illustrate two jacks useful in putting the present invention into effect.

Figure 1 shows a facade retaining structure 1 in situ on a facade 2 of a building. The facade-retaining structure 1 comprises two towers 3 interconnected by a plurality of trusses 4. Each tower 3 is of square cross-section, having four legs 5 defining the corners of the square. The legs 5 are connected at intervals along the height of the tower 3 by horizontal members 6. The tower 3 is also provided with a plurality of inclined members 7 each connecting a leg 5 to a horizontal member 6. Also shown is a plurality of struts 8 connecting horizontal members 6 in the same plane, to enhance the structural integrity of the tower 3. Each tower 3 is secured to a foundation 9 at ground level.

Projecting toward the facade 2, from the tower 3 are a plurality of stub members 10. The trusses 4 are supported and secured to the towers 3 by means of the horizontal members 6 and the stub members 10. Each truss 4 comprises two spaced-apart parallel horizontal elements 11A, 11B which are interconnected by a plurality of inclined connecting members 12. The horizontal element 11A closest to the facade 2 is termed the facade boom, whilst the element 11B distant from the facade 2 is termed the rear boom.

The facade 2 is fixed to the truss 4 at intervals along the length of the truss 4. Conventional fixing means, such as a threaded bolt passed through an aperture in the facade 2 and through the horizontal element 11A of the truss 4 closest to the facade 2 may be used. Conventional wooden packing between the horizontal element 11A close to the facade 2 and the facade 2 may be employed.

The afore-mentioned facade-restraining structure 1 is constructed from a number of specific components. The most fundamental component is an elongate channel section 15 as shown in Figure 2. The elongate channel section 15, which is preferably pressed from mild steel, comprises a planar base 16, two spaced-apart side walls 17 each extending generally perpendicularly with regard to the plane of the base 16 and two short returns 18, each extending inwardly from the free end of a respective side wall 17. Each side wall is connected to the base by an inclined section 19. This basic section 15 has a high structural integrity.

Provided along the base 16 of the channel section 15 is a series of regularly spaced pairs of apertures 20, 21. Each pair of apertures 20, 21 is aligned across the width of the base 16. Moreover, the distance of one aperture 20 from a centre line 22 of the base is the same as the distance from the other aperture 21 to the same centre line 22. This regular spacing is continued along the whole length of the elongate channel section 15. It is preferred that the distance between the centre of each aperture 20, 21 in the base 16 to the centre line 22 of the base is 40 mm.

Each side wall 17 of the elongate channel section 15 is provided along its length with a series of similarly regularly spaced apertures 23, 24. The apertures 23, 24 in the side walls 17 are aligned with a respective pair of apertures 20, 21 in the base 16. Moreover, the apertures 23, 24 of each series of apertures provided on the side walls 17 are disposed on a line parallel to the length of the channel section 15. The perpendicular distance from the centre of each aperture 23, 24 in a side wall 17 of the section 15 to the plane 25 of the base 16 is preferably less than half the distance between the centre of each aperture 20, 21 in the base 16 to the centre line 22 of the base 16: in a preferred embodiment, that former distance is 35 mm.

Figure 3 shows an elongate unit 30 in accordance with the second aspect of the present invention. The elongate unit 30 comprises two base-to-base identical elongate channel sections 15 as shown and described in Figure 2. The two elongate channel sections 15 are slightly spaced apart by a space 31 such that the distance D between the corresponding apertures 23 in the side walls 17 on one side of the elongate unit 15 is the same as the distance D between the centres of the apertures 20, 21 in the base 16 of each unit. This ensures a basic constructional unit 30 to which other different, or identical, units may be fixed. The two elongate channel sections 15 from which the elongate unit 30 is constructed may be spaced apart by a spacing

element (not shown) at intervals along the length of the unit 30.

In Figures 4 to 6, details of a tower in accordance with the third aspect of the present invention are shown. The tower 3 is shown, in Figure 6, to be of a square cross-section and to comprise four legs 5 defining the corners of the tower 3. Each leg 5 consists of an elongate unit 30 as shown in Figure 3. The legs 5 are secured with respect to each other at intervals along the length of the tower 3 by means of horizontal members 6, which may be either an elongate channel section 15 as shown in Figure 2 or an elongate unit 30 as shown in Figure 3. In addition, struts 8 connect and secure together horizontal members 6 in the same plane. Moreover, the horizontal members 6 are secured to the legs 5 by means of inclined members 7. Further inclined members 35 are shown (in Figure 5) to extend between the front and rear legs 5.

Finally, the stub members 10 are secured to each leg 5. The stub members 10 extend perpendicularly away from the tower 3 and are used to assist in supporting a truss (not shown) which, in turn, acts to support a facade of a building.

Figures 7 to 9 show a truss 4 in accordance with the fourth and fifth aspects of the present invention. The trusses shown in Figures 7, 8 and 9 are slightly different but are designed to have a similar function. The truss 4 shown in Figure 7 comprises horizontal members 40 and 41. Horizontal member 40 is an elongate unit as shown in Figure 3 whilst the horizontal member 41 is an elongate channel section as shown in Figure 2. In Figures 8 and 9, the horizontal members 42 and 43 are both elongate units as shown in Figure 3. The horizontal members 40, 41, 42, and 43 are joined by tubular connecting members 44. The trusses 4 shown in Figures 7 to 9 have varying widths.

A cross-section through the truss 4 of Figures 8 and 9 is shown in Figure 10. Thus, the horizontal members 42, 43 are identical and parallel, one of the horizontal members 42, 43 being oriented through 90° about its length relative to the other horizontal member.

Generally, the horizontal member adjacent the facade will comprise an elongate unit in accordance with the second aspect of this invention, the two sections of the unit preferably being spaced 26mm apart.

Detail of the connection of the tubular connecting members 44 to the horizontal members 42, 43 is shown in Figures 11 and 12. Thus, Figure 11 shows one type of connection using a planar gusset plate 45. The planar gusset plate 45 (which is shown in detail in Figures 23 and 24) is secured in the space between the elongate channel sections 15 of the elongate unit 30 by appropriate fixing means. At its other end, the gusset plate 45 is secured to an end plate 46 (as shown in Figures 27 to 32) of the tubular connection member 44. The width of the gusset plate 45 is less than the spacing between the two elongate channel sections 15 of the elongate unit 30 which makes up the horizontal member 43 of the truss 4. Thus, packers 46 (as shown in detail in Figures 33 and 34) are required to provide the correct spacing.

In Figure 11A an alternative, connecting means of the tubular connecting member 44 to the horizontal member 40 is shown. Here there is provided a T-shaped gusset plate 47 (as shown in detail in Figures 25 and 26) which is fixed in the channel of an elongate unit 15 of the horizontal member 42. The gusset plate 47 is also secured to the end plate 46 (see Figures 27 to 32) of the tubular connecting member 44.

As mentioned above, the spacing between two corresponding apertures in corresponding side wall 17 of two channel sections 15 of an elongate unit 30 is the same as the distance between the centres of a pair of apertures in the base. This spacing is common to all of the constructional elements which may be used in association with the elongate unit 30. Thus, for example, a further elongate channel section can be bolted by its base to co-planar side walls of an elongate unit 30. It is occasionally, therefore, necessary to provide packers between the two elongate channel sections 15 in order to space the channel sections 15 correctly. Alternatively, other constructional units may serve as the packer, such as the gusset plate shown in Figure 11. Here, however, further packers e.g. 46, of narrower width than the whole space may be required.

Figures 12 and 13 show Detail C of Figure 5. Figure 13 is a view in the direction XIII-XIII in Figure 12. The horizontal members 6 are secured to a leg 5 of the tower by first end plates 50. Detail of first end plate 50 is shown in Figures 49 and 50. The stub member 10 to which a truss (not shown) is secured is fixed to the leg 5 of the tower by second end plate 51 having a T-cross section. In addition, the inclined member 7 is fixed to the leg 5 by a third end plate 53, the end plate 53 and tubular inclined member 7 being integral. Detail of the second and third end plates is shown in Figures 53 and 54, and Figures 41 and 42, respectively.

Figures 14 and 15 show Detail D of Figure 4. The inclined members 7 have integral fourth end plates 53A (as shown in Figures 51 and 52) by which the inclined members 7 are secured to the leg 5 of a tower.

Figures 16 and 17 show Detail E of Figure 4. The inclined members 7 are secured to one of the horizontal members 6 by integral fifth end plates 53B as shown in more detail in Figures 55 and 56.

Figures 18 and 19 show Detail F of Figure 6, and show how the horizontal struts 8 are secured to the horizontal members 6. Thus, the horizontal struts 8 have integral fourth end plates 53A (as shown in Figures 51 and 52) which are secured in the channel of the elongate channel section 15 which makes up the horizontal member 6.

A combination of fourth 53A and fifth 53B end plates may be used at opposite ends of the inclined member 7 (see Figure 77).

Figures 20 to 22 show how the legs of a tower are formed; thus, the leg 5 of a tower is not necessarily made from a single long elongate unit 30 as shown in Figure 3. Rather, a series of shorter elongate units 30 may be spliced together. The splice may be a short splice as shown in Figure 20 or a long splice as

shown in Figure 21. A cross-section through either of these splices is shown in Figure 22. In Figure 20, a long splice plate 55 is positioned in the space between the two elongate channel sections making up the elongate unit, to space the two units 15 apart. Further splice plates 55 or 56 are placed on the side of each channel of each elongate unit 15 and appropriate securing means, such as respective nuts and bolts are used to hold the splice and two lengths of elongate unit together. Further long splice plates 55 may be employed to strengthen the sides of the elongate unit 30. The long splice plate 55 is generally used towards the bottom of the tower, whilst the short splice plate may be used towards the top of the tower, where the stresses are likely to be lower. Detail of the short and long splices is shown in Figures 35 and 36, and Figures 57 and 58 respectively.

In Figures 39 and 40 and Figures 43 and 44 there are shown two types of connector plates 60 or 61. The first connector plate 60 is of angular section and may be used to join together two adjacent elongate units which are either parallel or perpendicular. The connector plate 61 as shown in Figures 43 and 44 may be used to connect two elongate units, or elongate channel sections, at right angles.

Figures 47 and 48 show a hanger which provides vertical support to the trusses, particularly at the remote ends of the trusses which may often protrude beyond the supporting towers. The hanger also gives the spacing between adjacent trusses. The arrangement of the bolt holes of the end plate of the hanger may vary. In one embodiment only two bolt holes may be provided.

Figures 59 and 60 and Figures 61 and 62 show two types of base plate 65 and 66. The base plate is used to secure the bottom of, for example, a tower as shown in Figure 1, to the ground or to a further foundation.

Figures 63 to 74 illustrate the splicing together of lengths of the elongate channel section 15 shown in Figures 2 and 3 to form a facade or rear boom (11A or 11B - see Figure 1). Figures 63 and 64 relate to the splicing of a facade boom 11A, at an off node point, Figure 64 being a cross-section on the dotted line shown in Figure 63. Splice plates and packers as shown in Figures 35/36 and Figures 33/34 respectively are used to join channel sections 15 together. In a similar fashion, the joining of channel sections 15 is shown in Figures 65 and 66; Figures 67 and 68; Figures 69 and 70, Figures 71 and 72; and Figures 73 and 74. Various splice plates, gusset plates and packers as shown in Figures 25/26, Figures 37/38, Figures 35/36 and Figures 33/34 are employed. The term node point as used herein is a point at which interconnecting members 12 are connected to a facade or rear boom to form a truss 4.

In Figures 75 and 76, the connection of an interconnecting strap 71 (as shown in detail in Figure 78) to a rear boom 11B is shown. Connection is achieved via an intermediate "gusset plate" 70 (as shown in detail in Figure 78) which sets up the correct angle for the interconnecting strap 71. In Figure 76, the rear boom is supported by a tubular strut or hanger 72, such as that shown in Figure 82. A strut 72 of the desired length is chosen to support the end regions of adjacent tusses. The struts 72 supplement the support given by a tower. Generally, the struts 72 will provide support between adjacent trusses and, ultimately, provide support for the trusses against the ground.

Figures 79 and 80 illustrate how two elongate sections 15 may be joined back-to-back in a permanent fashion. The required spacing is determined by a spacing lug 80 which is welded at intervals between the back-to-back sections; thereafter, an end plate 82 is welded to the ends of the back-to-back sections 15 to join the sections 15.

The jacks 86 and 88 shown in Figures 81 to 84 may be used in the situation where a support structure is being constructed for a building and the dimensions and angles of the walls and rooves are such that none of the standard components will suffice. Both jacks 86 and 88 have a base 90 and an upper, supporting platform 92 which has bolt holes 93. The platform 92 is moveable relative to the base 90. In both jacks 86,88, the upper platform 92 has a depending shaft 94 received in a socket 96 of the base 90. This permits longitudinal movement of the platform relative to the base. The shaft 94 is capable of being fixed in the socket by a fixing means (not shown) such as a bolt. In addition, the platform 92 of the jack 86 is capable of pivoting about a pivot point 98 thereby to allow the platform 92 to be set at an angle to the base 90. The jacks are particularly useful for walls which are not exactly vertical or for providing rigidity between walls which are not at a regular angle to each other. However, this should not be construed as limiting the use of the jacks which may be employed in many different circumstances. The jacks should preferably be capable of withstanding a load of at least 30 tonnes.

Some of the accompanying drawings include specific dimensions. These dimensions are in millimetres and represent the presently preferred dimensions. However, the preferred distances could be varied to suit a particular requirement.

Claims

1. An elongate channel section intended for use as a component of a support structure which is intended to support a region or regions of a building or to support cladding, the channel section comprising a planar base, two spaced-apart side walls extending generally perpendicularly with regard to the plane of the base, and two short returns, each extending inwardly from the free end of a respective side wall, the base being provided along its length with a series of regularly spaced pairs of apertures and each side wall being provided along its length with a series of similarly regularly spaced apertures.

2. A channel section according to claim 1, wherein respective pairs of apertures in the base are aligned across the width of the base with one aperture of each pair being on one side

of the base, a predetermined distance from the centre line of the base, and with the other aperture of each pair being on the other side of the base the same predetermined distance from the said centre line.

3. A channel section according to claim 1 or 2, wherein the distance between adjacent apertures on the one side of the base or the distance between adjacent apertures on the other side of the base is greater than the distance between each aperture of a respective pair, of apertures.

4. A channel section according to claim 1, 2 or 3, wherein each aperture of the side walls is aligned with a respective pair of apertures in the base.

5. A channel section according to claim 1, 2 or 3, wherein the apertures of each series of apertures provided on the side walls are preferably disposed on a line parallel to the length of the section.

6. A channel section according to any preceding claim, wherein the perpendicular distance from each aperture in a side wall to the plane of the base is less, preferably only slightly less, than half the distance between a pair of apertures in the base.

7. A channel section according to any preceding claim, wherein the spaced-apart side walls are connected to the base directly, or each side wall is connected to the base by a strip which is inclined to the base and a respective side wall.

8. An elongate unit comprising two identical or substantially identical elongate channel sections in accordance with any preceding claim, the two sections being secured together and arranged base-to-base such that the channels of each section face in opposite directions and corresponding side walls of the two sections lie in the same plane, the two sections being spaced-apart such that the perpendicular distance between the series of apertures in one side wall of one section and the series of apertures in the co-planar side wall of the other section is equal to the spacing between adjacent pairs of apertures in the base of either elongate channel section.

9. A tower of square or other rectangular cross-section, having four legs defining the corners of the square or other rectangle, each leg being an elongate unit in accordance with claim 8 and adjacent legs being connected at intervals along the height of the tower by a plurality of rigid connecting members.

10. A tower according to claim 9, wherein each of the rigid connecting members is an elongate channel section in accordance with any one of claims 1 to 7 or, alternatively, is an elongate unit in accordance with claim 8.

11. A tower according to claim 10, wherein the legs are also connected together by tubular connecting members.

12. A truss comprising two parallel, spaced-apart elongate units in accordance with claim 8, one of the two elongate units being orientated about its length by 90° relative to the other of the two elongate units, the two elongate units being secured with respect to each other by a plurality of connecting means.

13. A truss comprising an elongate unit in accordance with claim 8 and, parallel to and spaced from the elongate unit, a channel section in accordance with any one of claims 1 to 7, one of the elongate unit and channel section being oriented about its length by 90° relative to the other of the elongate unit and channel section, the elongate unit and channel section being secured with respect to each other by a plurality of connecting means.

14. A truss according to claim 12 or 13, wherein the connecting means are inclined to the length of the elongate units/channel section of the truss.

15. A method of supporting the facade of a building comprising:

(i) erecting at least two towers, each in accordance with any one of claims 9, 10 or 11, a predetermined distance from the facade;

(ii) securing at least one horizontal truss in accordance with any one of claims 12 or 13 between the at least two towers such that an elongate unit or a channel section of the truss lies close to and parallel to the facade; and

(iii) securing the truss to the facade by means of a plurality of fixing means.

16. A method of erecting a region of cladding, comprising:

(i) erecting at least two towers, each in accordance with any one of claims 9, 10 or 11;

(ii) securing at least one horizontal truss in accordance with any one of claims 12 or 13 between the at least two towers; and

(iii) securing to the truss panels of a cladding, and securing the edges of adjacent panels together to provide a continuous region of cladding.

17. A building, or a region of a building, comprising a support structure constructed from a plurality of towers in accordance with any one of Claims 9 to 11 and a plurality of trusses in accordance with any one of Claims 12 to 14, there being secured to the support structure panels of a cladding which form the skin of the building or region of building.

18. A building, or a region of a building, according to Claim 17, wherein the cladding is outside the support structure.

19. A building, or a region of a building, according to Claim 17, wherein the cladding is inside the support structure.

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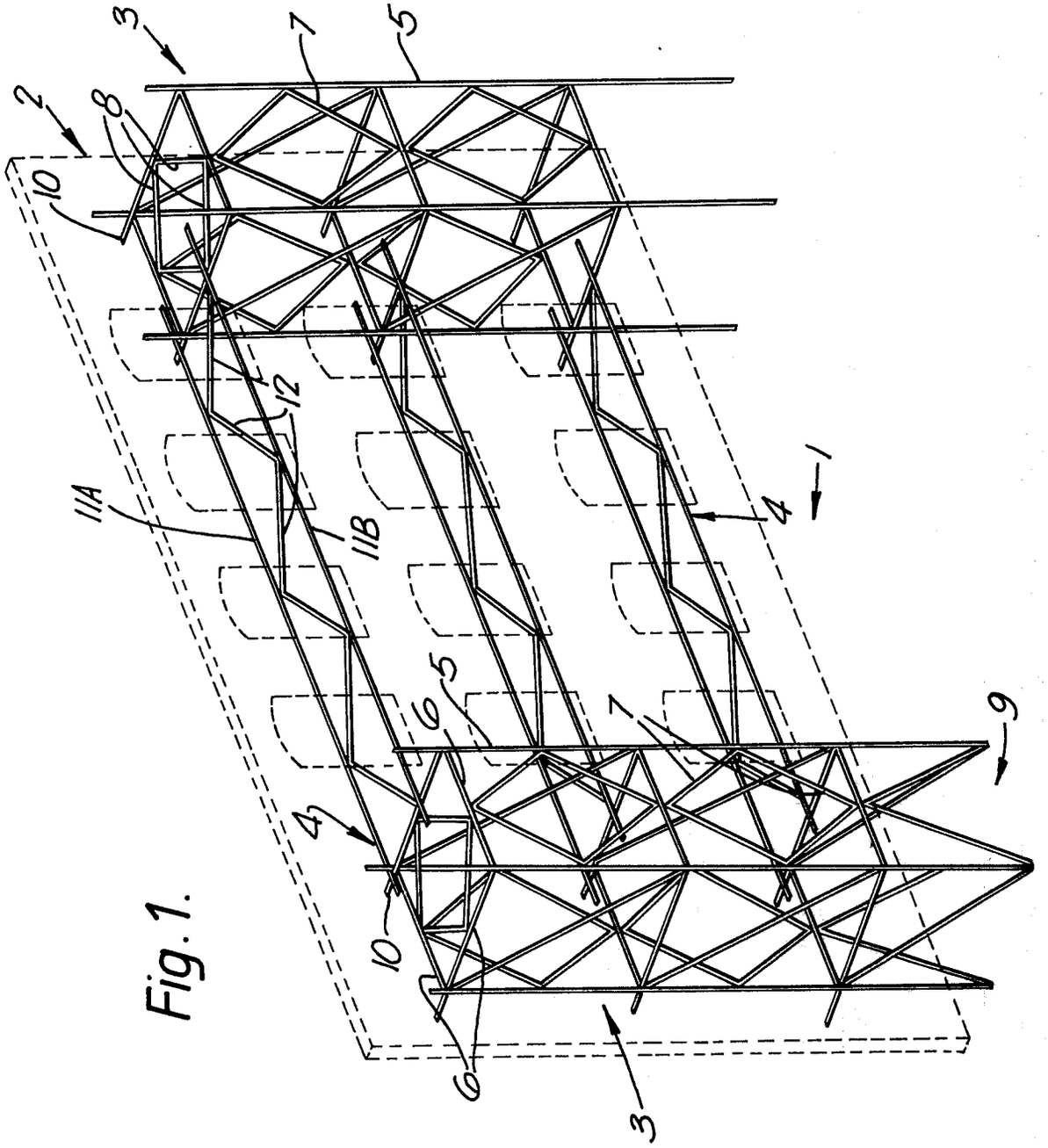
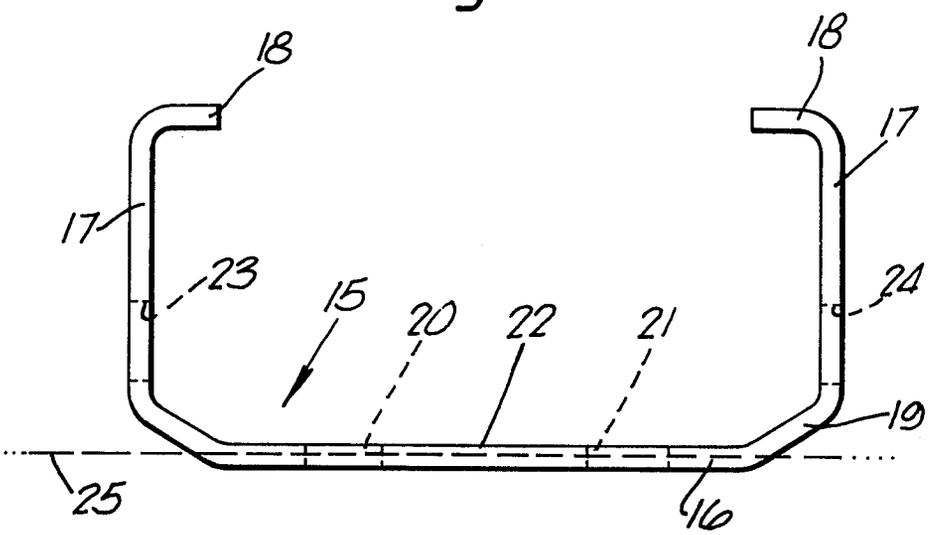


Fig. 1.

Fig. 2.



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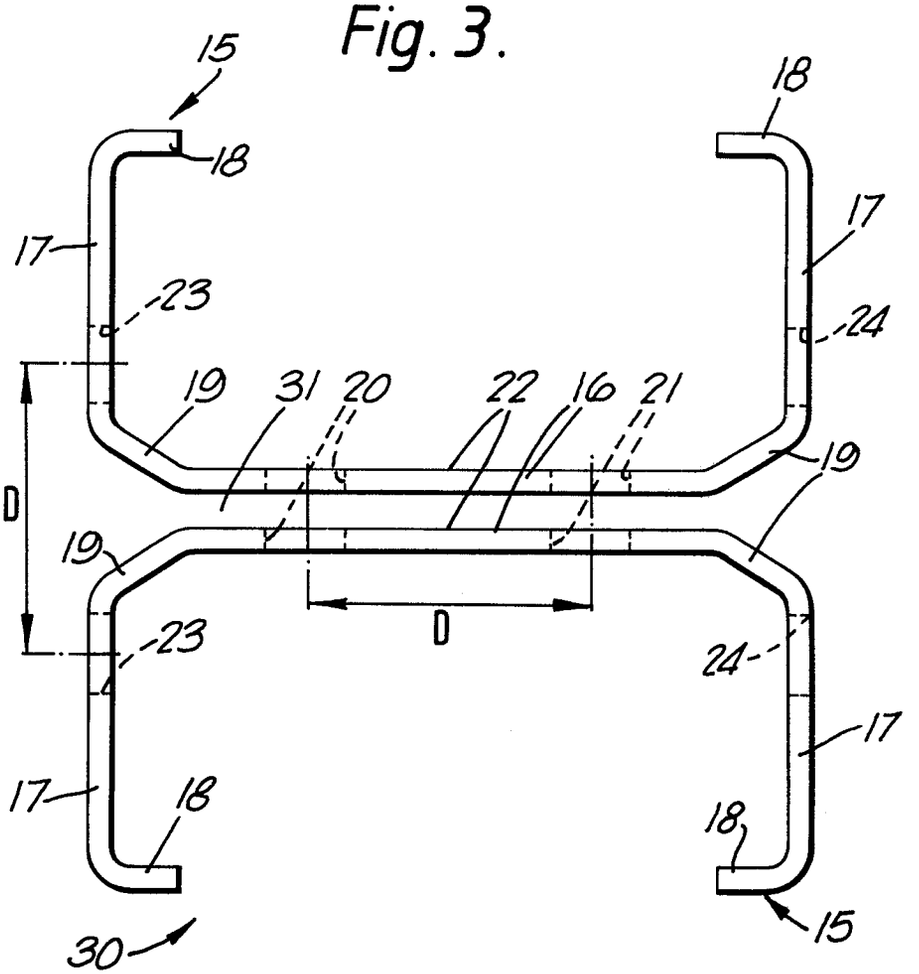

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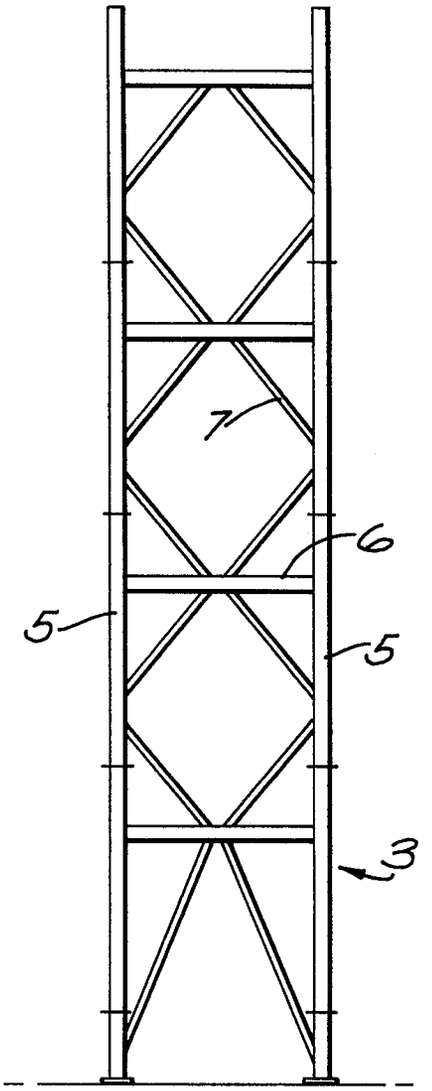

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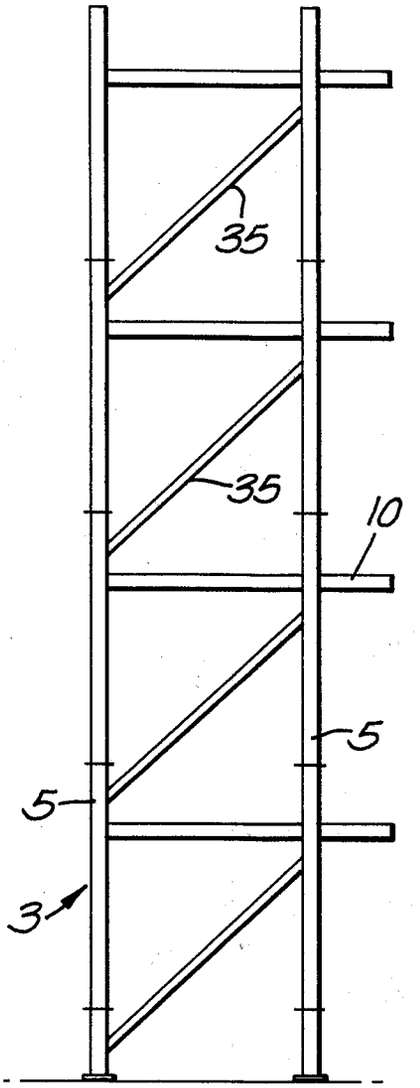

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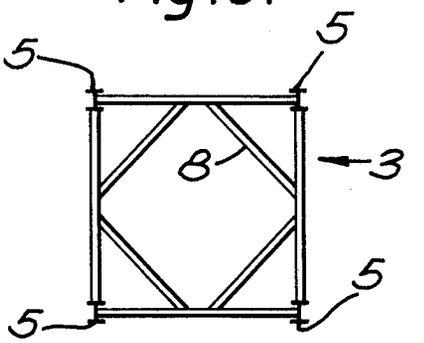

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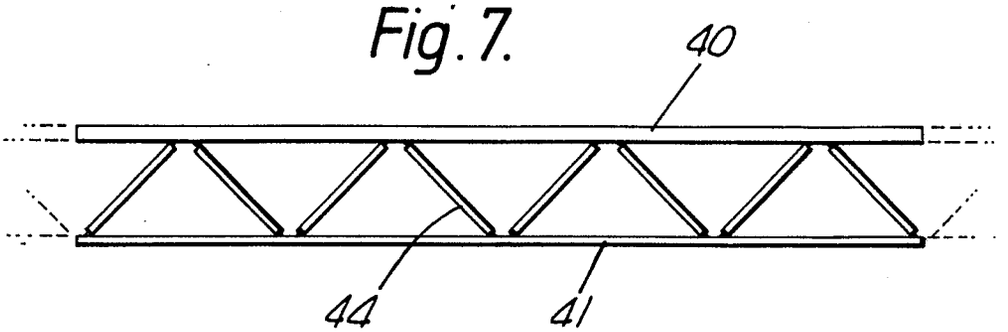

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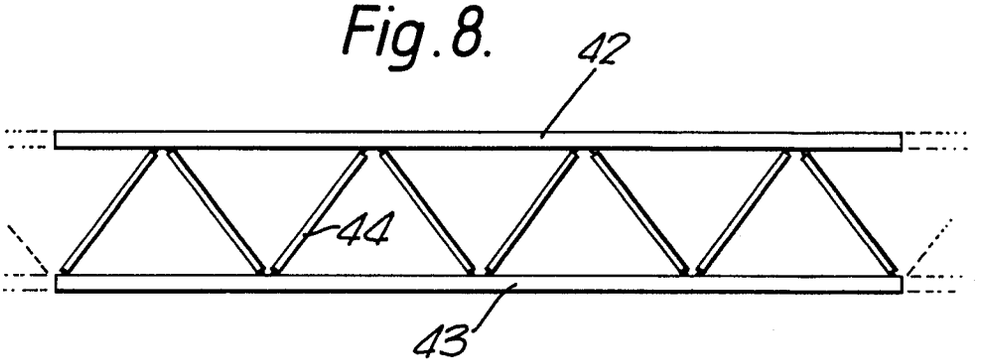

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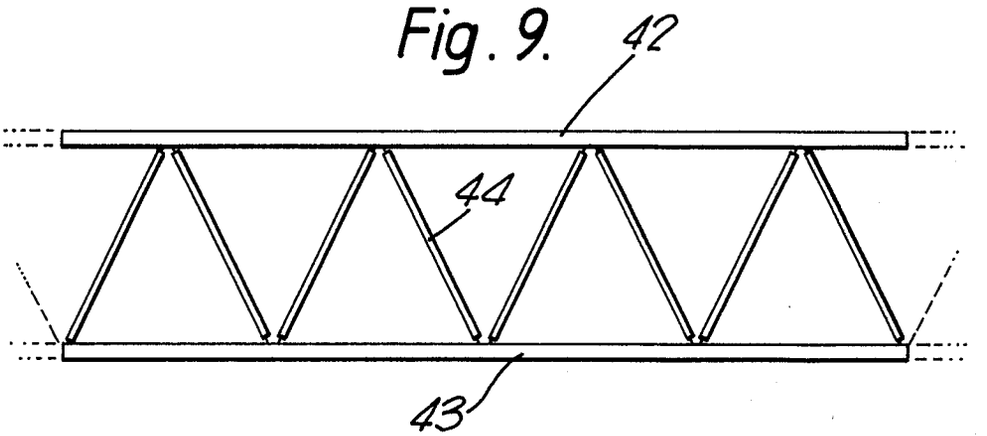

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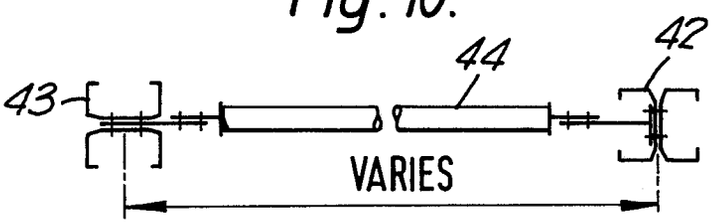

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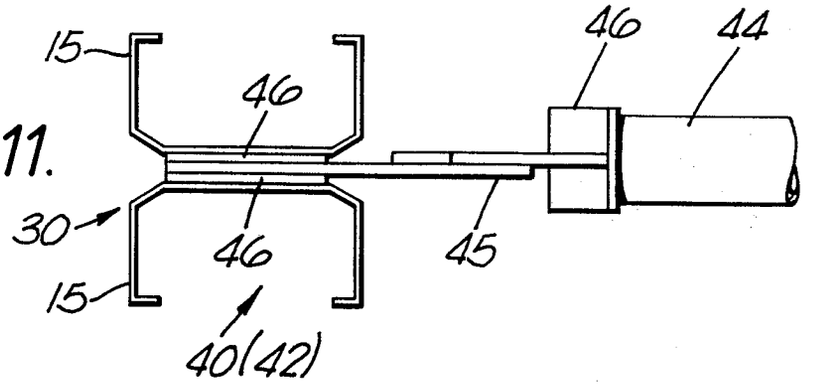


Fig.11A.

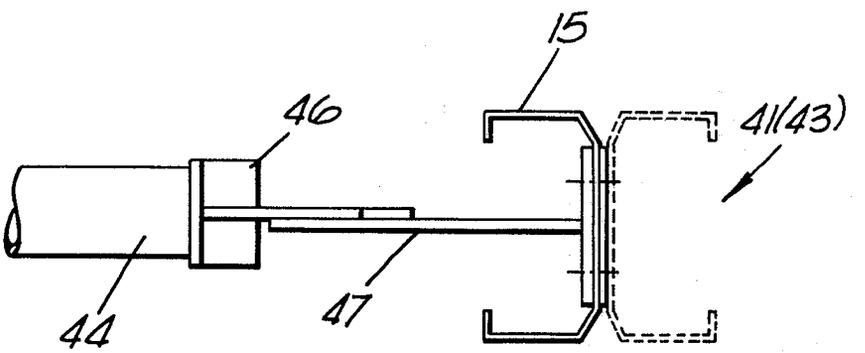
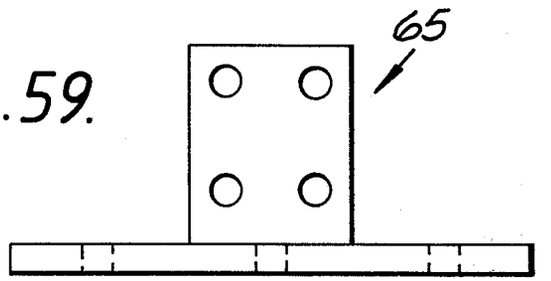


Fig.59.



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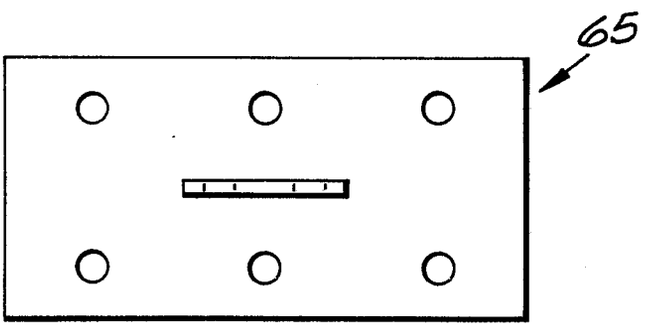

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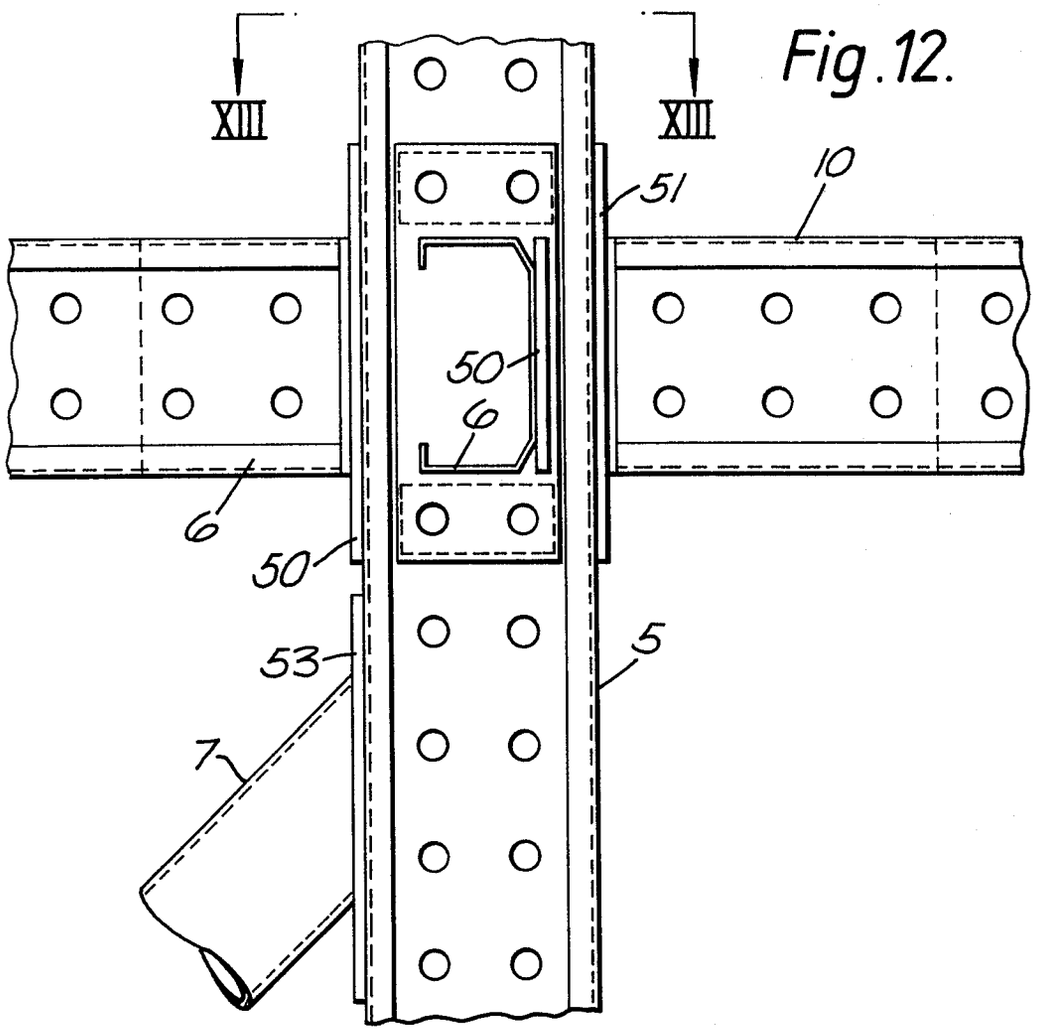

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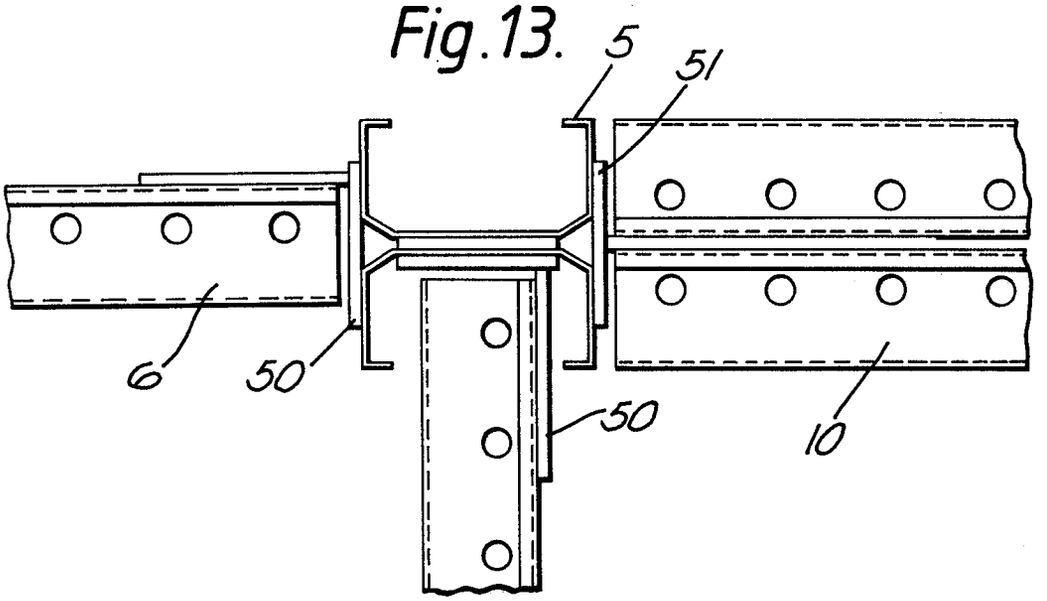

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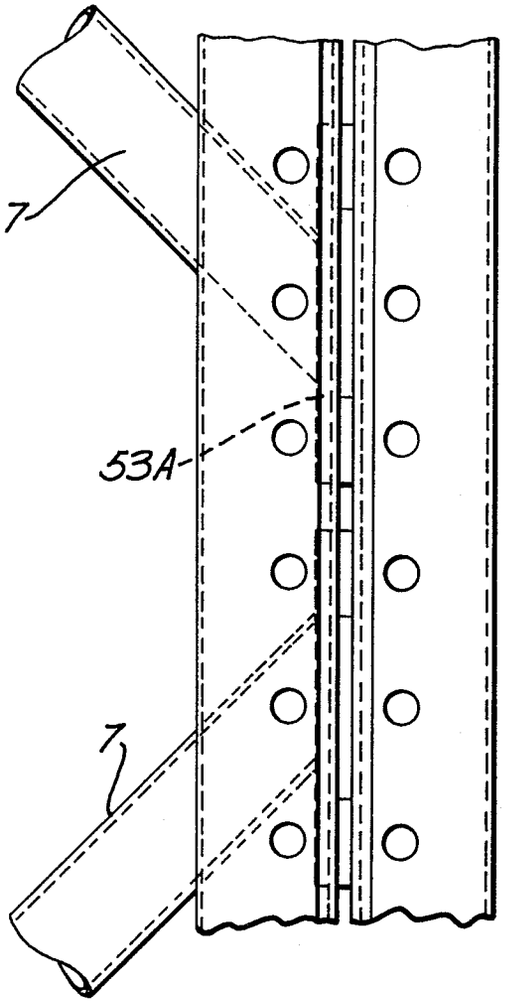
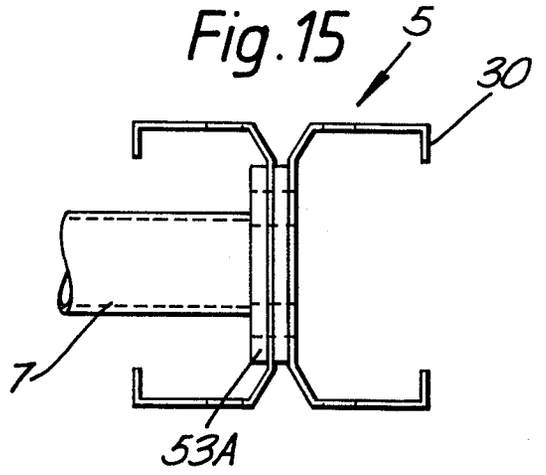


Fig.15



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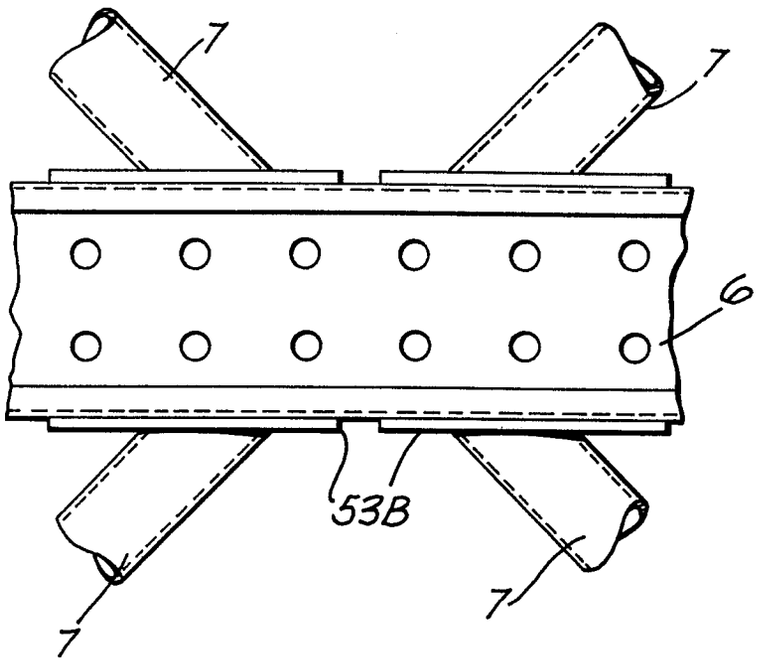

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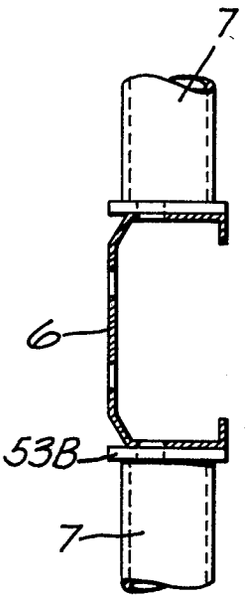

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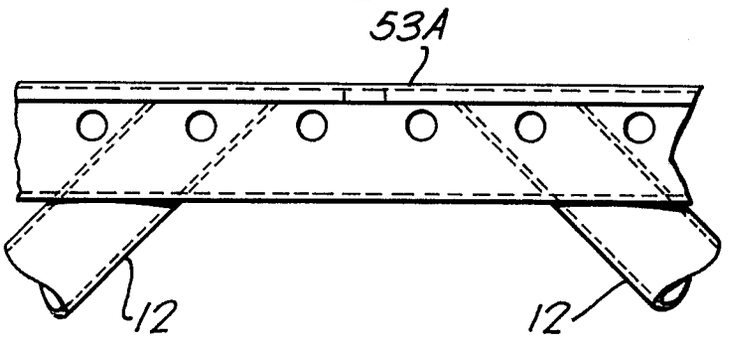

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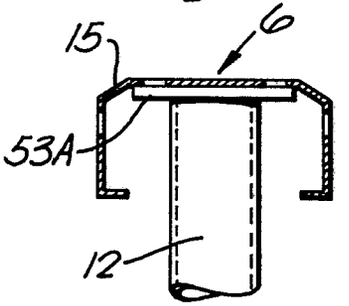

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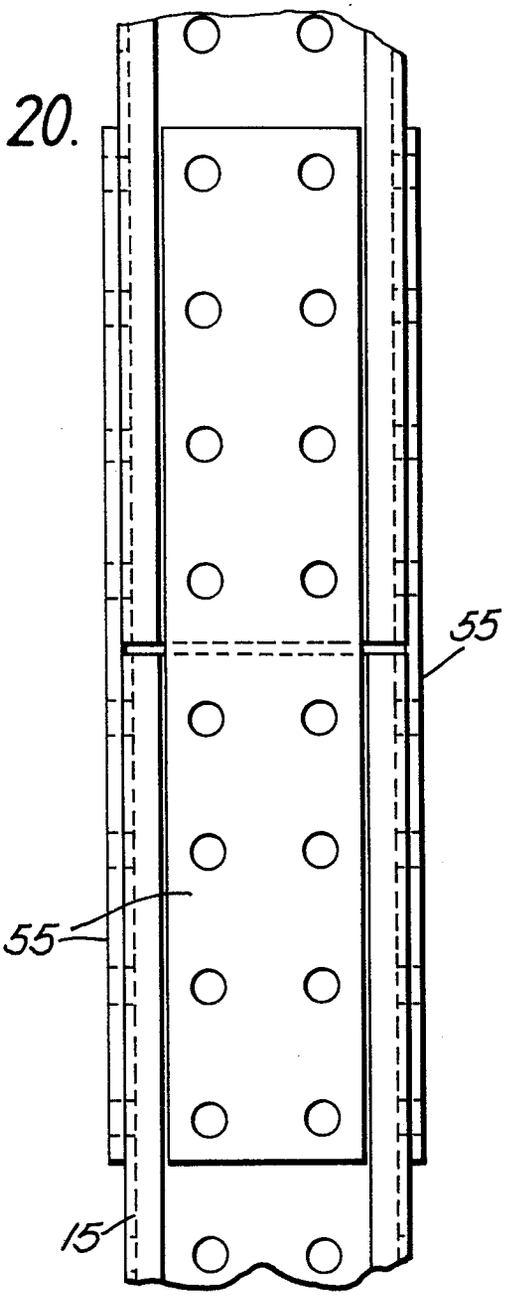

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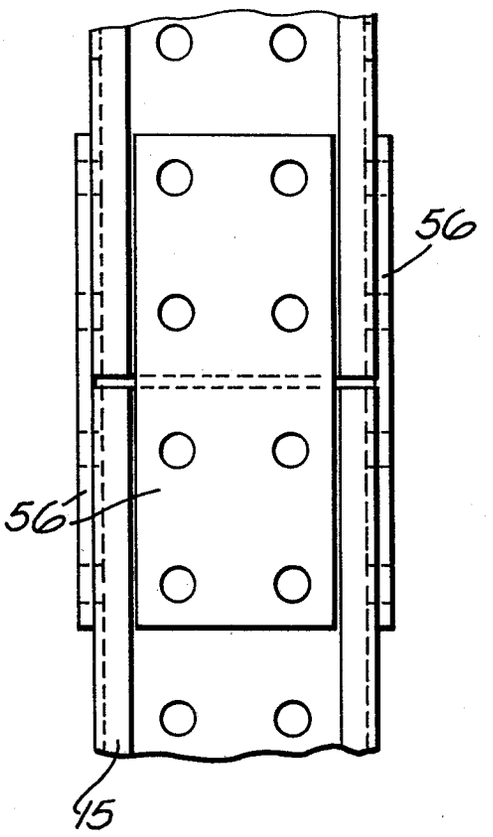


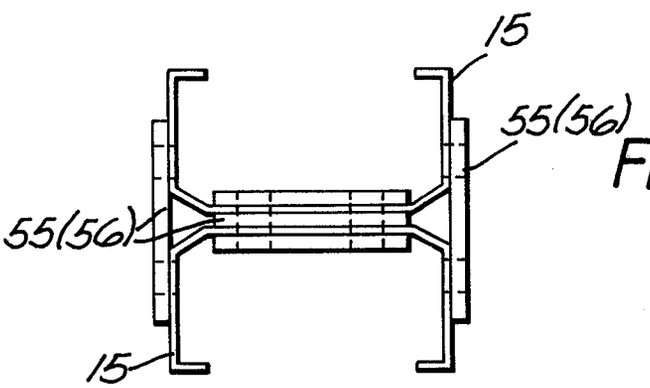
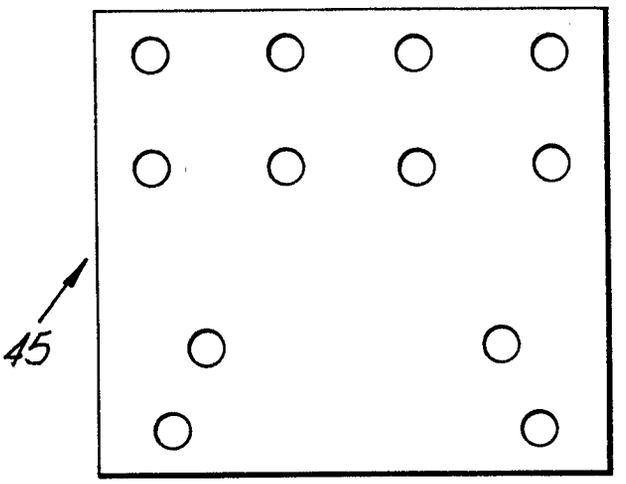


Fig. 22.

Fig. 23.

Fig. 24.



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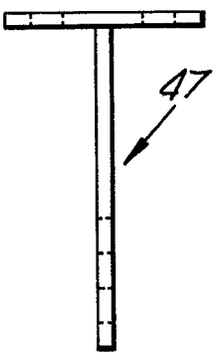


Fig. 26

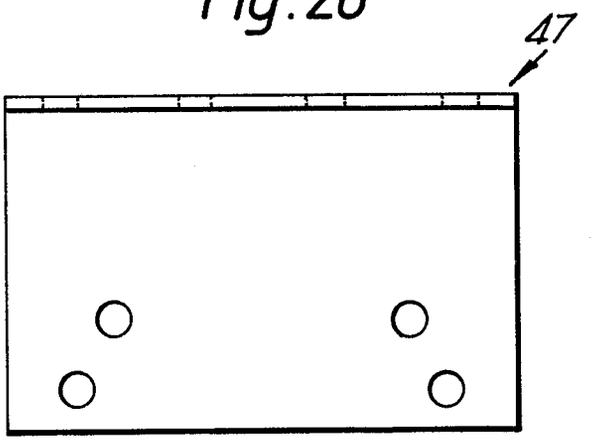
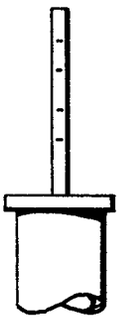


Fig. 45.

Fig. 46.

Fig.27.



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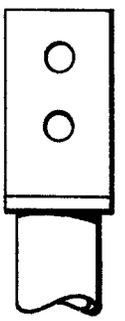

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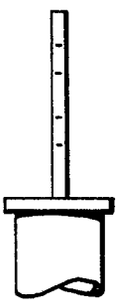

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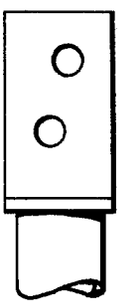

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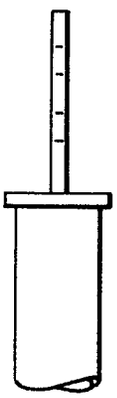

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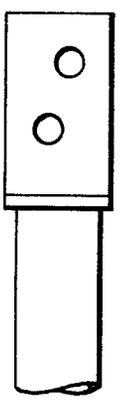
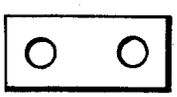


Fig.33.

Fig.34.



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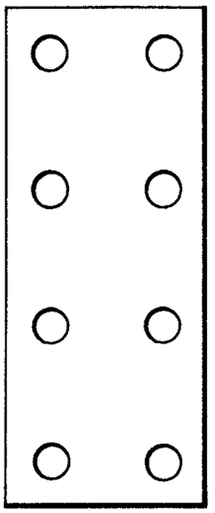


Fig.36

Fig.57.

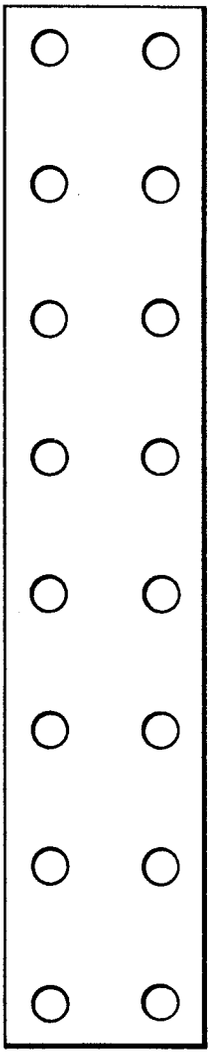


Fig.58.

Fig.37.

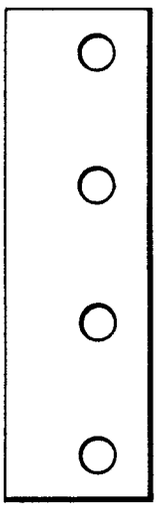
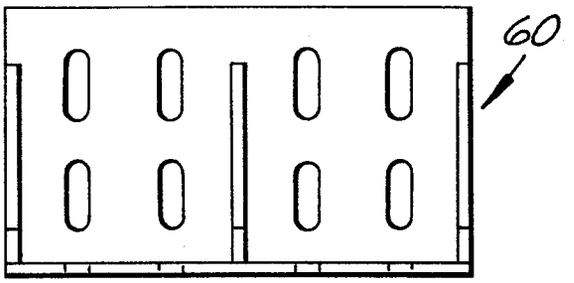


Fig.38.

Fig.39.



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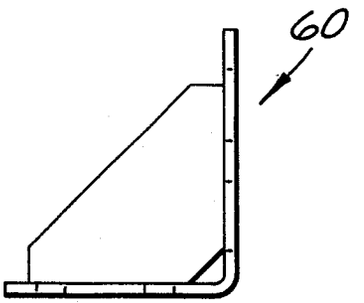

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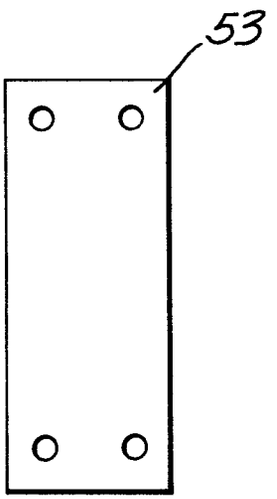

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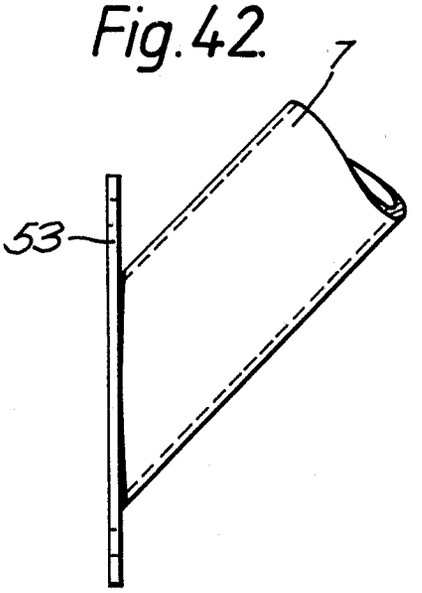

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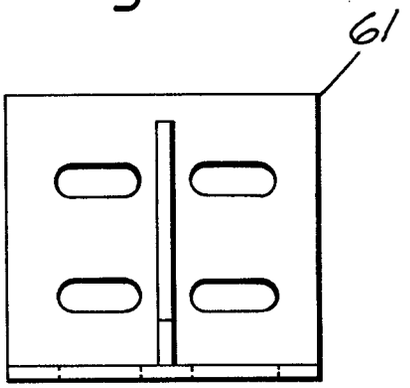

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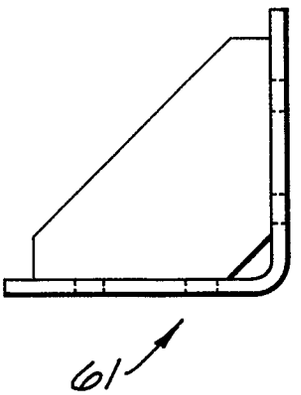

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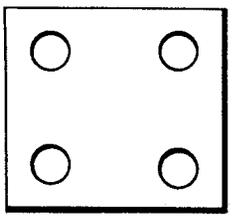

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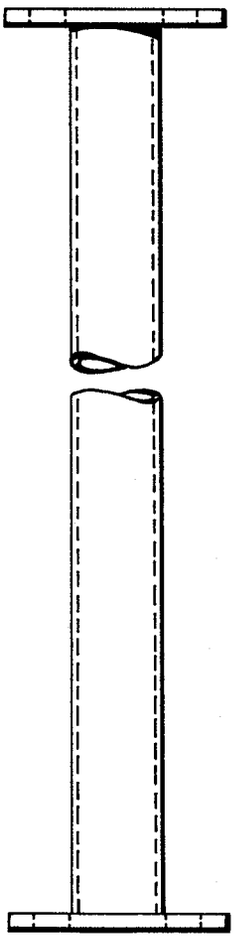

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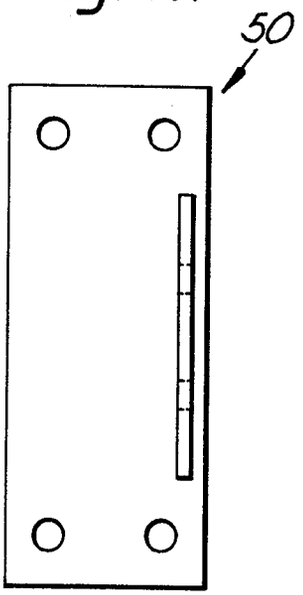

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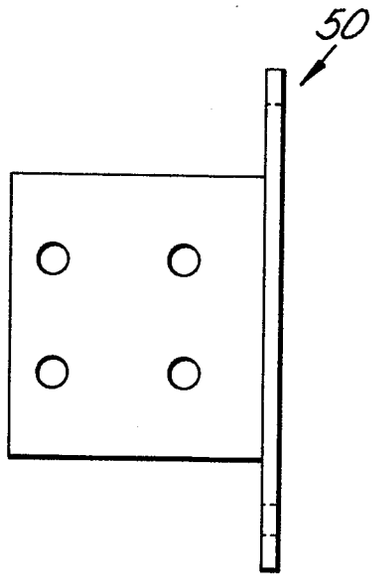

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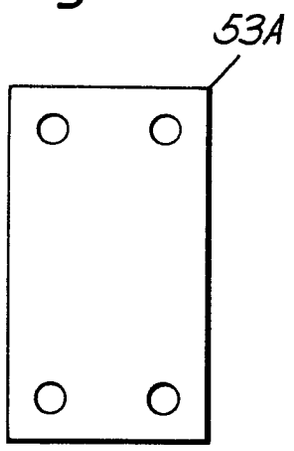

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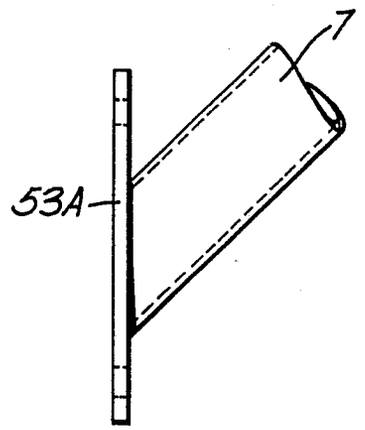

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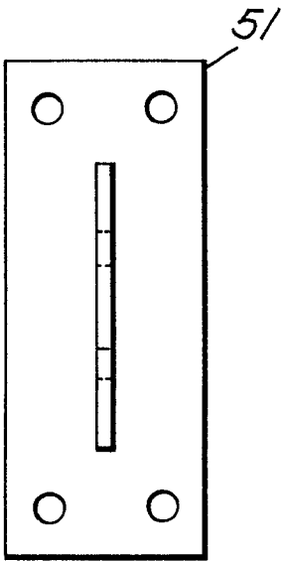

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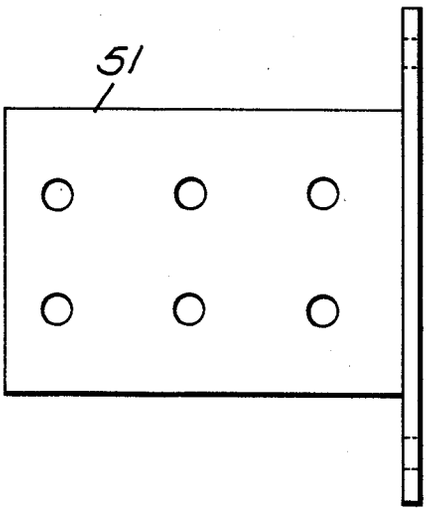


Fig.55.

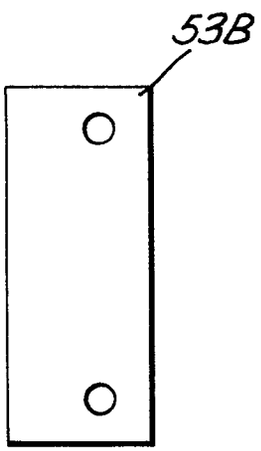


Fig.56.

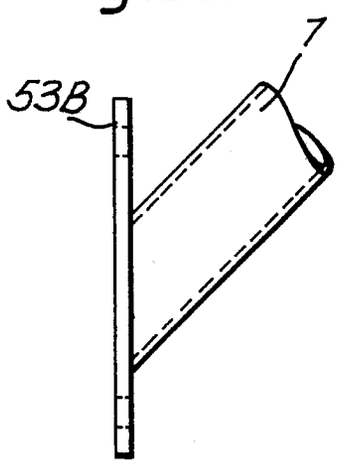
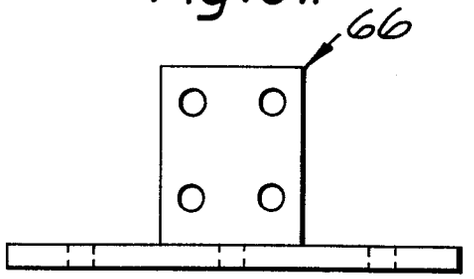


Fig.61.



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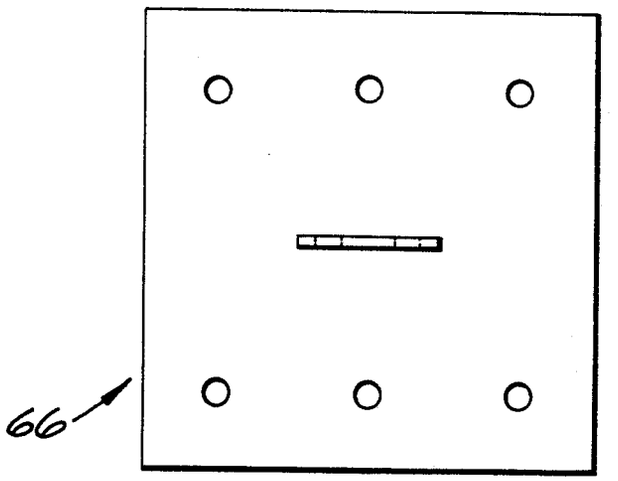

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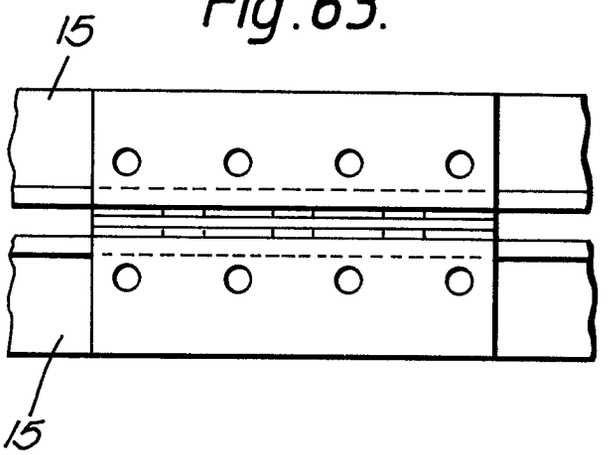


Fig.64.

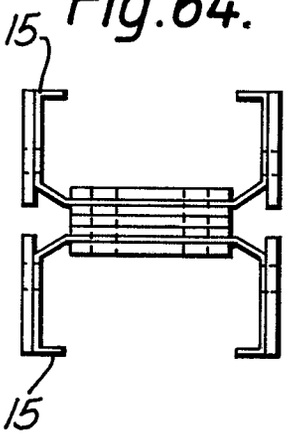


Fig.65.

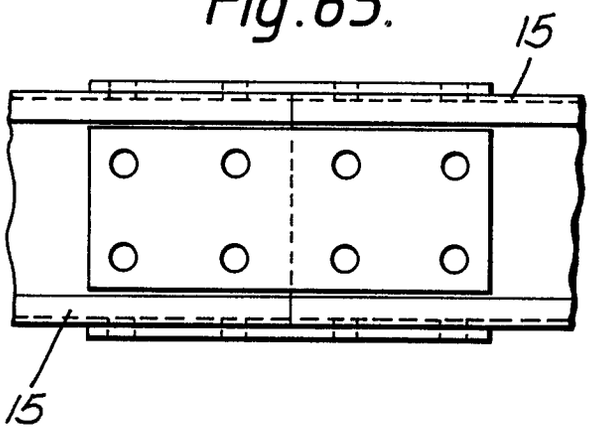


Fig.66.

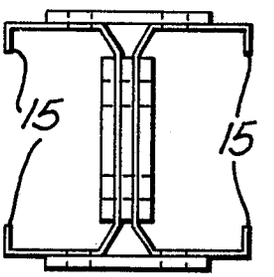
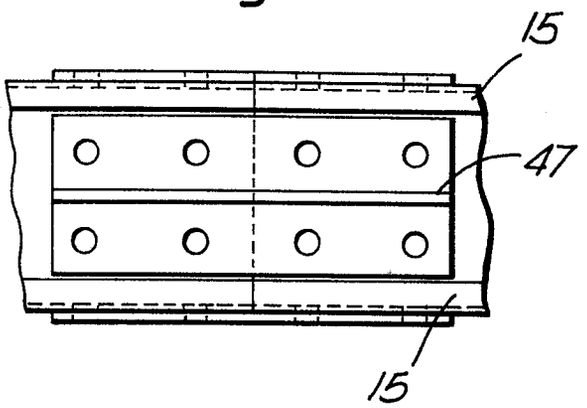


Fig. 67.



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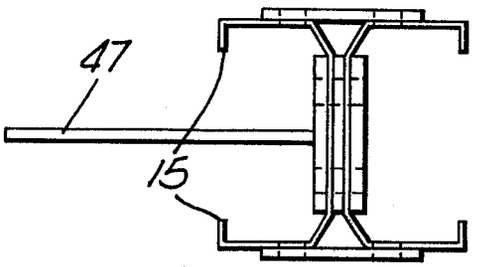

Fig. 69.

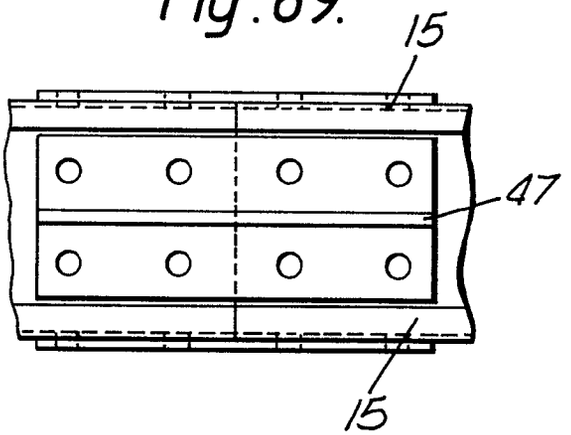

Fig. 70.

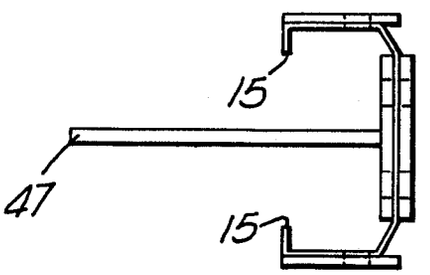

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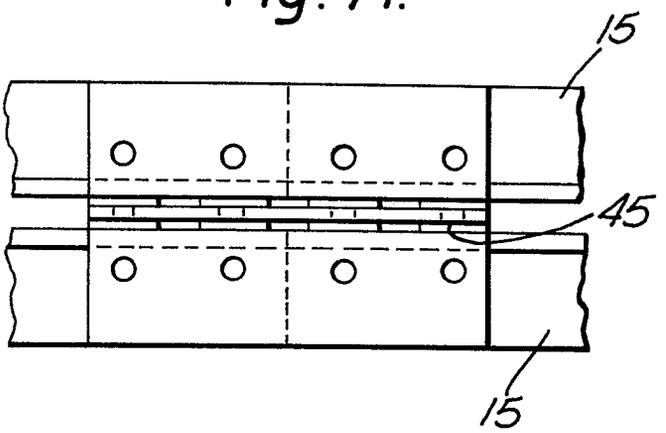
Fig. 71.



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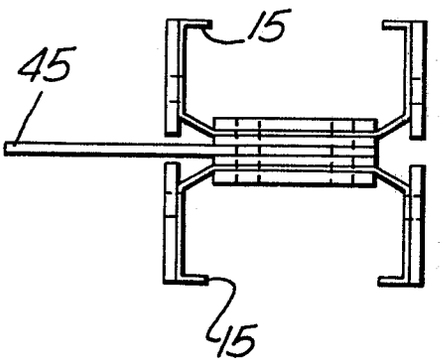

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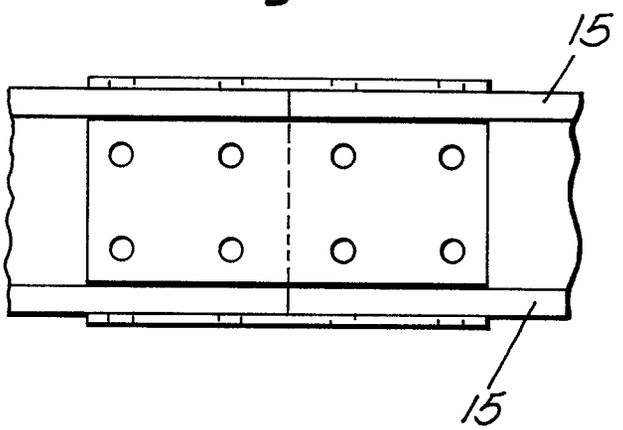

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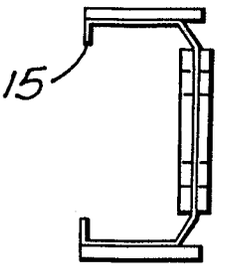

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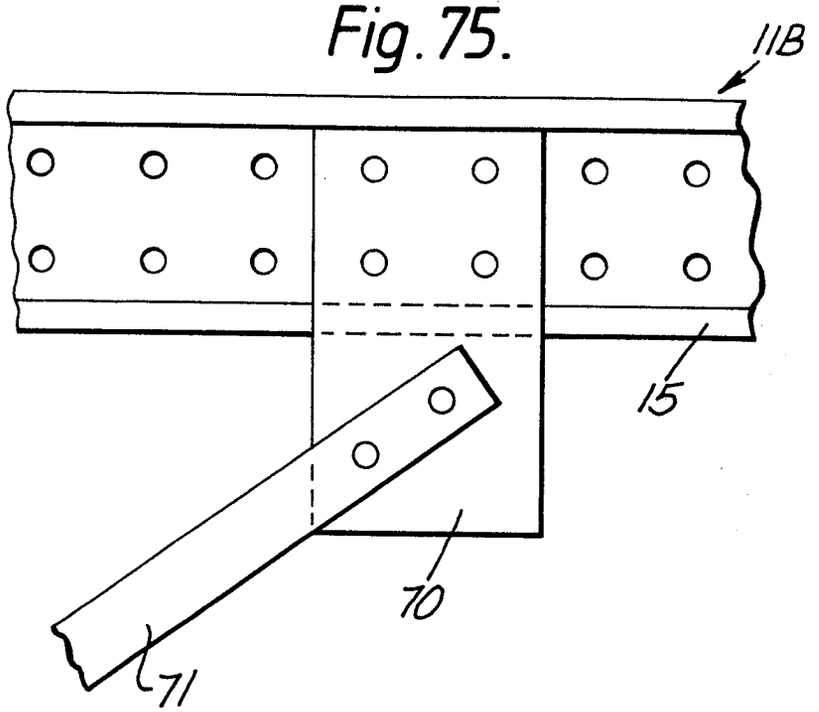


Fig. 76.

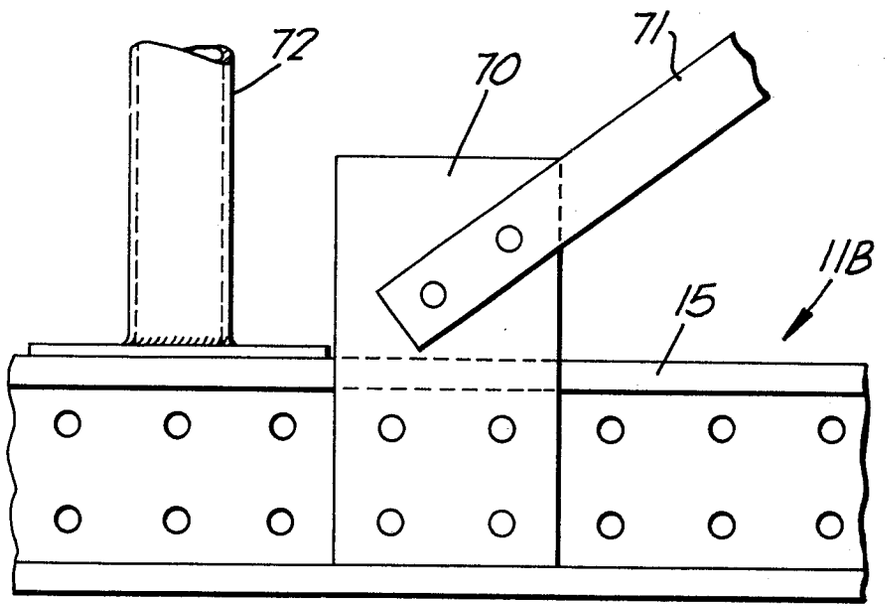


Fig. 78.

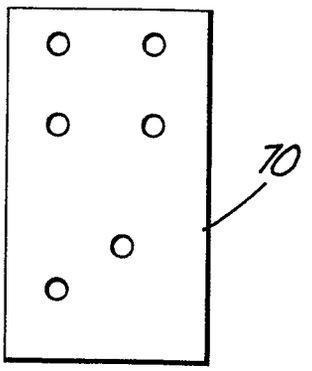
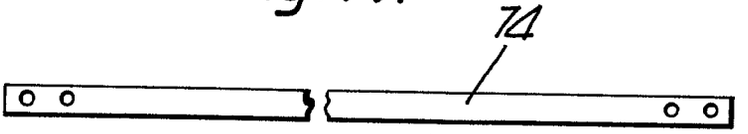


Fig. 77.

Fig. 79.



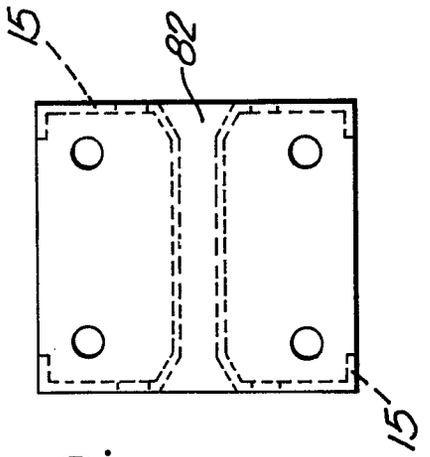


Fig.80.

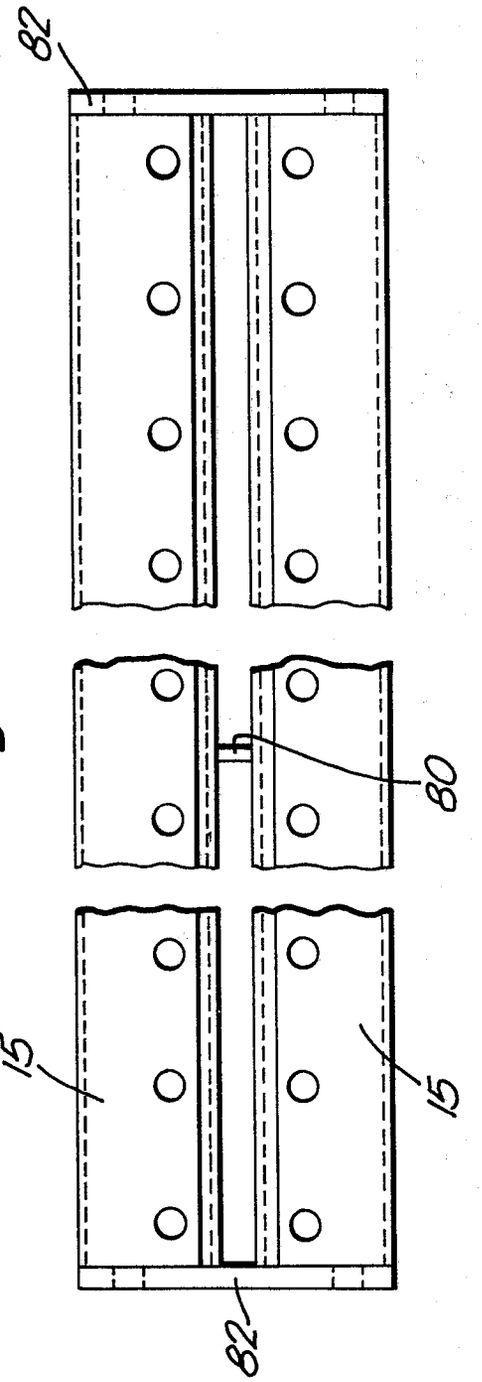
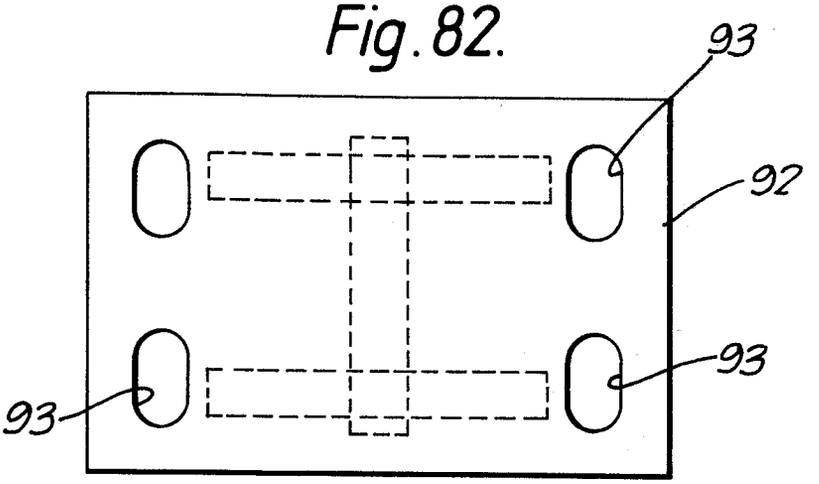


Fig.81.

Fig. 82.



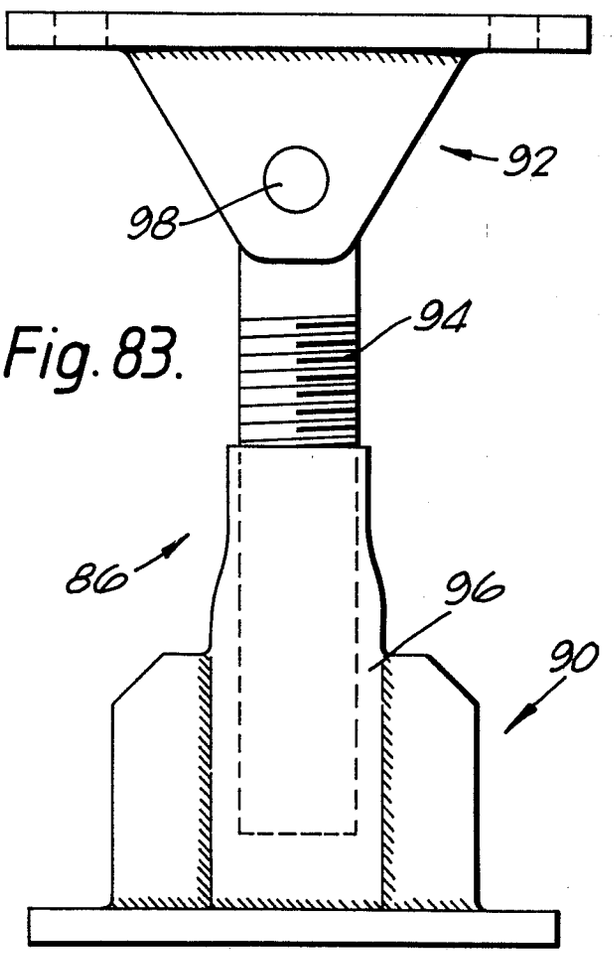
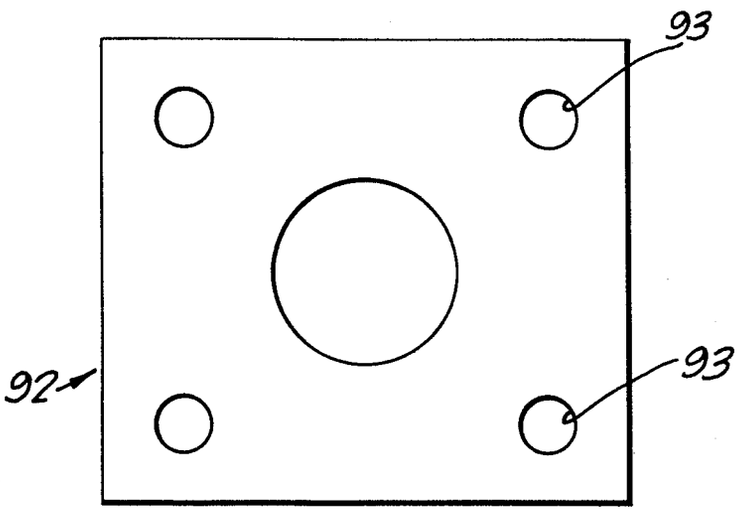


Fig. 83.

Fig.84.



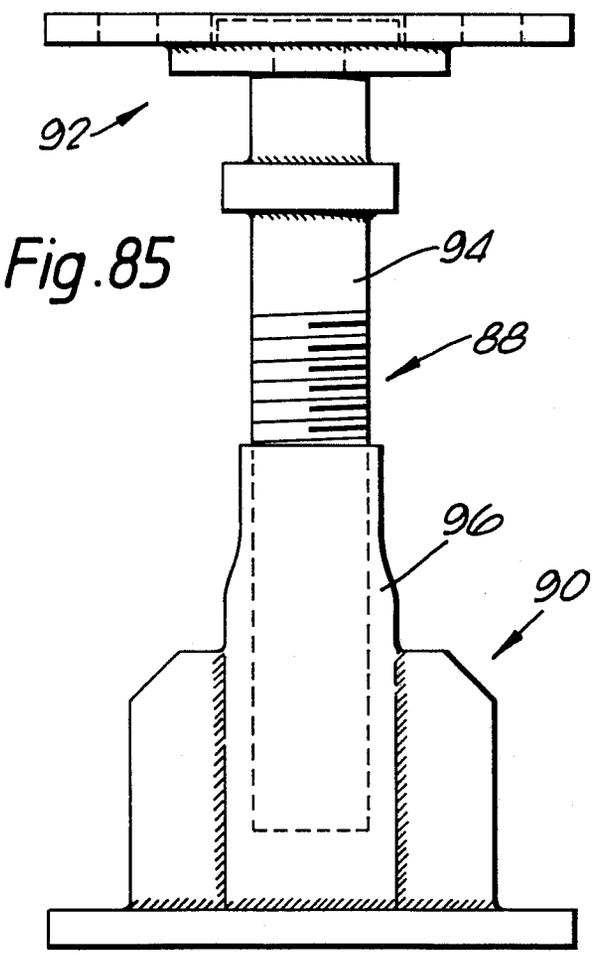


Fig.85