(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 179 646 B1**

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **07.08.91**

(51) Int. Cl.5: **B21D 13/02**, B21D 53/02, F28F 3/02

(21) Application number: **85307595.0**

(22) Date of filing: **21.10.85**

(54) Heat exchanger fin arrays.

(30) Priority: **22.10.84 IE 2711/84**

(43) Date of publication of application:
30.04.86 Bulletin 86/18

(45) Publication of the grant of the patent:
07.08.91 Bulletin 91/32

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(56) References cited:
DE-A- 2 438 595
DE-A- 2 918 191
GB-A- 2 014 483
GB-A- 2 014 484
US-A- 1 767 605

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EP 0 179 646 B1

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Description

The present invention relates to heat exchanger profiled fin arrays and to methods for their manufacture, and to heat exchangers including such profiled fin arrays and to methods for their manufacture.

By "fin" in this context is meant a heat conductive material for attachment to a heat exchanger to enhance heat transfer by increasing the surface area across which heat transfer takes place.

By "profiled fin array" in this context is meant fin which has mutually parallel ridges or crests in a repeating pattern, the surface area of such a fin array being substantially greater than the area of the surface to which it is attached.

The traditional method of making fin arrays which are profiled will now be described. A long strip of flat sheet metal, which may be unwound from a coil of such metal, is used. The long strip is fed through apparatus for making the profile. There emerges from the apparatus a strip of sheet metal having parallel ridges or crests each extending from one side of the strip to the other side thereof. The profiled strip is subsequently divided into shorter lengths as required by dividing parallel to the ridges or crests. The result of producing successive arrays from the strip is a batch of profiled fin arrays all of which have the same width which is determined by the width of the strip of sheet metal. If a batch of a different width is required this is made from a coil or strip of different width. DE-A-2918191 (Baal) describes a method of making profiled fin arrays.

The traditional method described above of making profiled fin arrays suffers from a number of disadvantages. Either the production of profiled fin arrays must coincide with production of the heat exchangers to which the profiled fin arrays are to be attached, or alternatively the profiled fin arrays and/or the heat exchangers must be stored until required. Furthermore, coils or strips of a variety of different widths must be obtained and stocked by the manufacturer. To lessen these disadvantages, manufacturers of central heating panel radiators have tended to limit the range of profiled fin arrays which they produce and to limit the variety of combinations of panel radiators and profiled fin arrays, in spite of market demand for a wide variety of different sizes of panel radiators, and also market demand for different sizes of profiled fin array attached to each particular size of panel radiator. In addition to the storage, stocking and product range drawbacks mentioned above, production of a variety of different sizes also has the drawback that both the apparatus for making the profiled fin arrays and also the apparatus which attaches the profiled fin arrays to the panel radiators tend to be under utilised as they are generally used for, respectively, making and attaching profiled fin arrays of a size smaller than the maximum size which they are capable of making and attaching.

Furthermore, storage of the batches of standard width may sometimes involve dividing the continuously produced profiled fin array into shorter standard lengths suitable for storage, rolling these shorter standard lengths for storage, and subsequently further dividing these shorter standard lengths into lengths as required, thus involving a second dividing operation and frequently resulting in scrap material.

The first aspect of the present invention is based on the appreciation that a profiled fin array can be divided not only in a direction parallel to the ridges or crests but in other directions also. The division of flat sheets of fin material is well known in the prior art, see for example UK-A-2014484 (Carrier Corporation), UK-A-2014483 (Carrier Corporation) and US-A-1767605 (Modine). The division of profiled sheets of fin material by dividing parallel to the ridges or crests is also well known, for example in the traditional method described above and also from the aforementioned DE-A-2918181 (Baal). The division of profiled fin arrays in a direction other than parallel to the ridges or crests is not known in the prior art.

In its first aspect the present invention provides a method of making heat exchanger fin arrays of a variety of different widths and of profiled shape as seen in longitudinal cross section from flat sheet material, characterised in that arrays of standard width and of profiled shape as seen in longitudinal cross section are made from flat sheet material of standard width, and the arrays of standard width are subsequently divided lengthwise into arrays of smaller width.

The method according to the invention presents the manufacturer with a number of advantages. He need obtain and store only one standard width of coil or strip material. He can fully utilize his machinery. He need no longer make and store batches of different fin array widths but can produce a standard width and divide it widthwise and lengthwise as and when required by the production schedule. No second cutting operation is involved and there is very little scrap. Alternatively, if he wishes to retain a storage system he need store only one standard width of profiled fin array which may be subsequently divided into smaller widths as necessary.

In accordance with a preferred feature of the invention, the flat sheet of material of standard width is provided with a pattern of weaknesses or other physical alterations for facilitating subsequent lengthwise division of the array of standard width and profiled shape. Provision of the above pattern of weaknesses or physical alterations is very advantageous in effecting the subsequent lengthwise division, as the lengthwise division of the profiled fin arrays, especially arrays of narrow rectangular cross section which are typically used in central heating radiators, would be extremely difficult using traditional equipment or methods.

Advantageously, the pattern is repeated across the width of the flat sheet material of standard width for facilitating subsequent division of the profiled fin array into any one of a number of different smaller widths.

The invention also provides a heat exchanger fin array of profiled shape as seen in longitudinal cross section, characterised in that the array is provided with a pattern of weaknesses or other physical alterations for facilitating lengthwise division into arrays of smaller widths.

The traditional method of making central heating radiators, of the type comprising a plurality of mutually parallel co-planar heat exchange elements with headers across the ends thereof and with profiled fin arrays attached thereto will now be described. The central heating radiator bodies and the profiled fin arrays are made separately. The central heating radiator bodies are made by assembling the tubes and headers. The profiled fin arrays are normally made in batches and stored in standard storage lengths, typically rolled in a tight spiral for convenience. These standard storage lengths are then cut to the length required on the central heating radiator by widthwise division. Usually this second division of the fin array material results in some scrap material.

DE-A-2918191 (Baal), which has already been mentioned above, teaches that fin arrays may be attached during manufacture of heat exchangers instead of being added subsequently. The Baal specification relates to a panel radiator which is made by taking a single sheet of metal, doubling it over on itself to form a radiator panel, and adding end pieces to close the panel. Baal teaches that where profiled fin arrays are to be provided on the two faces of the panel radiator, the two arrays may be conveniently fixed to the same side of the sheet metal before the sheet metal is doubled over to make the panel.

GB-A-2014484A (Carrier Corporation) also teaches that fin arrays may be included in a heat exchanger during manufacture instead of being added subsequently. Carrier relates to plate fin coil assemblies. These are generally used in refrigerators, air conditioners and the like and are enclosed or encased and the aesthetic and safety considerations which arise in the case of central heating radiators do not arise in the case of plate fin coil assemblies. A plate fin coil assembly comprises a three dimensional array of mutually parallel heat exchange elements, each heat exchange element being provided with a plurality of fins extending perpendicularly thereto. The fins are of flat sheet material. The traditional method of making plate fin coil assemblies comprised making standard modules and then assembling the required number of modules together to make a plate fin coil assembly of the required size and was thus different to the traditional method of making central heating radiators which were not made in modular fashion but were made to the required size. The traditional method of making plate fin coil assemblies was extremely laborious because it involved the individual handling of each fin of each module. The Carrier Corporation specification teaches making plate fin coil assemblies by a new method intended to greatly reduce the handling of fins, a problem peculiar to the traditional method. The new method taught by Carrier comprises making a large three dimensional assembly of mutually parallel heat exchange elements and mutually parallel sheets of flat fin material, the heat exchange elements extending perpendicularly to the sheets of flat fin material, and then dividing the large assembly into smaller assemblies. Each division of the assembly involves dividing a large number of sheets of flat fin material, each sheet being divided in a direction perpendicular to the direction of the parallel heat exchange elements. The flat sheet material is divided by rupturing along perforations provided for that purpose, leaving jagged edges which would not be acceptable in central heating radiators. The new method taught by Carrier, while offering the stated advantage of reducing fin handling, does not fundamentally alter the traditional method of producing plate fin coil assemblies and in particular does not offer any advantages in terms of product range produced, machinery utilization or flow line production.

The present invention provides a method of making heat exchangers of the type comprising mutually parallel co-planar heat exchange elements, headers at the end regions of the heat exchange elements, and a fin array which is profiled as seen in longitudinal cross section disposed parallel to the heat exchange elements, the method enabling heat exchangers of a variety of different numbers of heat exchange elements and with fin arrays attached to all or only some of the heat exchange elements, to be made, characterised in that a standard number of heat exchange elements are disposed in mutually parallel co-planar relationship, a fin array of standard width which is profiled as seen in longitudinal cross-section is attached to the standard number of heat exchange elements thereby making a heat exchange sub-assembly of standard width, the sub-assembly of standard width is then divided into smaller sub-assemblies by dividing the fin array of standard width lengthwise into smaller widths each with a corresponding smaller number of heat exchange elements attached thereto, the smaller sub-assembly may then be optionally added to further heat exchange elements or to further sub-assemblies to provide the required co-planar arrangement, and headers of appropriate length are then added to the co-planar arrangement to form heat exchangers.

The method in accordance with the present invention of manufacturing the particular type of heat exchanger specified above offers many advantages over the traditional method. For example the method in accordance with the invention allows full utilisation of machinery in a flow line production and yields a wider product range. Thus the manufacturer can produce a particular size of sub-assembly such as, for example, eight flat tubes with a connecting fin array, and can subsequently divide this sub-assembly into smaller sizes, for example, six tubes and two tubes, by cutting the sheet metal in the region between the two flat tubes, or, where a larger radiator (say ten tubes) is required, he can add on extra tubes with or without fins.

The invention also provides a sub-assembly for use in making a heat exchanger, the sub-assembly comprising a plurality of mutually parallel co-planar heat exchange elements held in mutually fixed relationship by a fin array which is profiled as seen in longitudinal section and is disposed parallel to the heat exchange elements and joined to each one of them, the fin array being provided with a pattern of weaknesses or other physical alterations for facilitating lengthwise division of the sub-assembly into smaller sub-assemblies.

The invention will now be described more particularly with reference to the accompanying drawings which illustrate, by way of example only, the manufacture and mounting of a finned hot water central heating panel radiator.

In the drawings;

Figures 1a to 1h are views of a piece of sheet metal at successive stages of the radiator sub-assembly manufacturing process;

Figures 2a, 2b and 2c illustrate the preferred pattern of slits and slots on the fin array to facilitate lengthwise division;

Figures 3a, 3b and 3c illustrate successive stages in the division of a sub-assembly into smaller sub-assemblies;

Figures 4a and 4b to 4i are views similar to Figure 2c of the preferred slit and slot pattern and a series of alternative patterns respectively;

Figures 5a to 5g schematically illustrate a known method of, and apparatus for, producing fins at successive production stages;

Figures 6a to 6f schematically illustrate the invention and show the method of, and apparatus for, producing the pattern and fins at successive production stages;

Figures 7a and 7b are, respectively, sectional elevation and plan views of a detail of the radiator showing how it is mounted to a wall by means of a bracket on the wall and an engagement piece for engaging between the radiator fins and the bracket;

Figures 8a, 8b and 8c are, respectively, side elevation, front elevation and plan views of the engagement piece;

Figures 9a, 9b and 9c are, respectively, side elevation, front elevation, and plan views of the bracket;

Figure 10 is a front elevation of a piece of metal from which both the engagement piece and the bracket may be pressed; and

Figures 11a to 11d are similar to Figures 1d, 1e, 1f and 1g respectively but illustrate two variations of the method, according to one of which a sub-assembly with fin arrays on both sides is made and subsequently divided and according to the other of which the pattern is limited to that necessary for division, for aesthetic reasons or to reduce tool wear or for fin strength.

Reference will initially be made to Figures 1a to 1h. Figure 1a shows an effectively continuous strip of sheet metal 10 (Figure 1a). Figures 1b and 1c show intermediate and final stages in the provision of a pattern 11 of parallel slits and slots. The method of and apparatus for producing the slit and slot pattern 11 will be described in more detail below. Figure 1d shows an intermediate stage in the provision of an array of fins 12. Figure 1e shows a length of slotted finned sheet metal cut from the continuous strip. The method of and apparatus for producing the array of fins 12 will also be described in more detail below. Figure 1f shows the length of slotted finned sheet metal attached by spot-welding to each one of a series of flat metal tubes 13. The spot-welding is carried out by passing the tubes 13 and the slotted finned sheet metal 10 through a multiple spot-welding machine. It will be appreciated from consideration of Figure 1f that the tubes 13 are held in their mutually parallel co-planar relationship only by the unslit portions 12a of the fins. The standard width radiator sub-assembly comprising tubes 13 and array of fins 12 may then be divided into the smaller sub-assemblies shown in Figures 1g. The division is achieved by cutting the previously unslit portions 12a of the fins 12. Thus a manufacturer can produce one standard width of radiator sub-assembly which can then be divided into any desired size. Cutting is done by means of a powered shears. Furthermore, as is shown in Figure 1h, an additional flat tube 13a without fins may be added to the sub-assembly where it is desired to produce a radiator in which it is not desired that the fin array should extend the full height of the radiator. Indeed a wide variety of different arrangements may be achieved with ease. For example larger radiator sub-assemblies of, say, twelve tubes may be made by simply joining two sub-assemblies of eight and four tubes. Unusual arrangements may be achieved if desired, such as for example panels in which the fins extend part way downwardly from the top of the radiator and part way upwardly from the bottom of the radiator but leave a gap in the middle for horizontally extending water connection pipes.

A variety of different radiators may thus be manufactured in a flowline in the following principal steps;

(a) uncoil sheet metal from a coil of sheet metal;

(b) form the pattern of slits and slots in the uncoiled sheet metal;

(c) form the fins

(d) cut to the different required lengths;

(e) introduce suitably arranged heat exchange tubes from a store of such tubes into the flowline and spot-weld each cut length to a number of tubes to form a radiator sub-assembly;

(f) if desired, divide the sub-assembly lengthwise into smaller sub-assemblies, which may sometimes be temporarily stored as required;

(g) if desired, introduce extra tubes or sub-assemblies from store into the flowline and add the extra tubes or sub-assemblies to sub-assemblies in the flowline; and

(h) introduce headers from a store into the flowline and add the headers to the sub-assemblies to form radiators.

Minor steps such as the provision of plural connections, additional strengthening welds, testing, painting and packaging have been omitted.

Step (f) will now be described in more detail. The proportions into which the uniform width sub-assemblies are divided are arranged so that insofar as possible the smaller sub-assemblies are used immediately in the flowline production. Where it is not possible to use the smaller sub-assemblies immediately, they are moved to temporary storage for use as soon as possible. If the smaller sub-assemblies are of a particular size which is not likely to be used in the near future, such as for example, sub-assemblies comprising just one or two tubes, these may be joined together to make larger sub-assemblies. These larger sub-assemblies may be used as one panel of a double panel radiator so that the joint line between the fin arrays is concealed between the two panels of the radiator.

To minimize the number of sub-assemblies of undesirable size being produced, such as for example sub-assemblies comprising just one tube, two different widths of coil may be used. Each radiator required to be produced during a particular period, for example a week, may then be made from one or other width or by combining sub-assemblies obtained from the two different widths.

The flowline described above can be used to make radiators other than the single panel finned radiators described above. For example, double panel radiators may be made by joining two of the single panel radiators produced as described above. Unfinned radiators may also be made in the flowline by omitting most of the above described steps and just introducing the tubes and attaching the headers to them.

Similarly, fin arrays provided with a pattern of slots to facilitate subsequent division may also be used with panels other than those which comprise a series of unjoined elements. In such cases, lengthwise division of the fin arrays may be carried out before the fin arrays are attached to the panels.

Referring now to Figure 2, the preferred pattern 11 of slits and slots to be applied will now be described in more detail. Figure 2a shows the preferred pattern 11 which consists of an array of longitudinal cuts k, having at each end thereof cut-outs or apertures j. The dotted lines indicate where the sheet metal will be folded. Figure 2b is a detail of the finished radiator, illustrating how the pattern 11 in Figure 2a appears in the finished radiator. Figure 2c is a view taken along IIC-IIC of Figure 2b. The various dimensions of the fin and slot patterns are represented in Figure 2a, 2b and 2c as "a", "b", "c", "d" and "f".

Referring now to Figure 3, there will now be described in more detail the division of a radiator sub-assembly consisting of heat exchange tubes 13 joined by a fin array having the preferred pattern 11 of slits and slots. Figure 3a is a view similar to 2c, showing a detail of the sub-assembly just before cutting. Cutting is done by means of a double-cutting powered hand-held shears (not shown) which removes (see Figure 3b) the bridging piece thereby dividing the assembly (Figure 3c). The shape of the cut-out j is intended to accommodate the cutting tool and also to eliminate sharp corners in the finished product.

Figure 4 (a) shows the presently preferred pattern 11 while Figures 4 (b) to 4 (i) show alternative patterns. In selecting a suitable pattern, various factors need to be taken into account, for example; the pattern should assist operation of the cutting tool; the pattern should not impede heat transfer from and within the fins and therefore the material removed should be as little as feasible and from as far away from the flat tubes as feasible; the pattern should not result in sharp corners in the finished product; the pattern should preferably not give an undesirable appearance to the finished product;

and the pattern should not result in too great a reduction in the strength of the fins.

It should be noted that the pattern of slits and slots does not impede conductive heat transfer within the fins, as such heat transfer takes place from the base of the fins along the walls to the top of the fins and is parallel to the pattern.

Referring now to Figure 5, there is schematically illustrated a known method of making fins from a coil of sheet metal. The purpose of illustrating and describing the known method is to assist in understanding the method of the invention which will be described later. Figure 5a shows incoming sheet metal 10a from a coil which is not shown and outgoing finned metal 10b. An upper forming tool 52 moves vertically under the action of a power press and a lower forming tool 53 is stationary. Also shown are a metal feed 54, a pressure plate 55, a device 56 (shown as a spring in the Figure) for applying a controlled force to the pressure plate 55, and devices 57 which apply a controlled force to the pressure plate 55 near the end of the stroke considerably greater than the force applied by device 56. The devices 56 and 57 may, for example, comprise controlled hydraulic or pneumatic cylinders.

In Figure 5a, the metal feed 54 has just fed the sheet metal 10a into position and the upper forming tool 52 is about to descend. In Figure 5b the metal feeder 54 releases the sheet metal 10a and the upper forming tool 52 has descended to meet the sheet metal. In Figure 5c, the upper forming tool 52 continues to descend, causing the metal to wrap around the lower forming tool 53 drawing both the unformed and formed sheet metal towards the tool 53. The metal feed 54 returns to its home position. In Figure 5d, the upper forming tool 52 continues its descent, driving the pressure plate 55 ahead of it under relatively light pressure from device 56. At this point, devices 57 also come into play causing the sheet metal 10a to be gripped between the upper forming tool 52 and the pressure plate 55. In Figure 5e, the upper forming tool 52 descends just a little further causing the gripped metal 10a to be tightly wrapped around the corners of both the upper and lower forming tools 52, 53 and thus producing relatively well defined corners on the material. In Figure 5f, the upper forming tool 52 ascends and the pressure plate 55, under the action of device 56, follows the upper forming tool 52, pushing the formed fin 10b off the lower forming tool 53. The metal feed 54 closes to grip the metal. In Figure 5g, the upper forming tool 52 continues to the top of its stroke. The metal feed 54 moves the metal forward. The forming cycle has returned to the stage illustrated in Figure 5a. The cycle is automatically repeated, forming one fin for each press stroke.

Referring now to Figure 6, the method and apparatus of the invention will now be described. some of the components are similar to those used in the known method described above and are designated by the same numerals. The additional components include stops 58 which limit the downward movement of the pressure plate 55 and devices 59 which apply a controlled force to the top tool to overcome the forces applied by devices 56 and 57 and also the natural resistance to bending of the sheet metal. A fixed lower block 60 contains the piercing and lancing dies for the pattern and a moveable upper block 61 supports the piercing punches 62 and lancing punches 63 and moves vertically together with the upper fin forming tool 52 under the action of the power press.

In Figure 6a the upper fin forming tool 52, piercing punches 62 and lancing punches 63 are about to descend. In Figure 6b the fins have been formed and the piercing punches 62 are about to make contact with the sheet metal. In Figure 6c the piercing punches 62 punch the sheet metal. In Figure 6d the lancing punches 63 come into contact with and part the sheet metal. In Figures 6c and 6d the stops 58 and devices 59 allow the upper fin forming tool 52 to remain stationary even though the press continues to descend. In Figure 6e the press returns to the top of its stroke. In Figure 6f further sheet metal is fed forward in readiness for the next stroke.

Alternatively, the pattern forming tool and the fin forming tool may be mounted in separate power presses. The sheet metal is then fed directly from thepattern forming tool and power press to the fin forming tool and power press using a pilot device to correctly locate the pattern in the fin forming tool.

Referring now to Figures 7, 8, 9 and 10, the radiator is mounted (see Figure 7) on a wall by means of an engagement piece 70 (illustrated in Figure 8) which engages firstly in the slots which were provided in the side walls of the fins to assist cutting, and secondly in a wall mounted bracket 71 (illustrated in Figure 9). The engagement piece 70 may slide horizontally relative to the bracket 71. The horizontal movement allows greater tolerance in the fitting of the brackets 71 to the walls and also allows for thermal expansion of the radiator. The mounting arrangement has a number of advantages. Firstly, it is not necessary to permanently attach any additional part or component to the radiator or to modify the radiator in any way to receive mounting hooks or brackets. Secondly, flexibility is offered in the choice of bracket location because there is an entire array of slots available. Thirdly, the mounting arrangement is at the back of the panel where it is concealed, which is aesthetically pleasing. Fourthly, the mounting arrangement is relatively inexpensive. Figure 10 shows how the engagement piece 70 and bracket 71 may both be pressed from a single piece of metal. In an alternative arrangement, the engagement piece 70 could be supported by a floor mounted bracket.

Referring now to Figure 11, there are illustrated two variations of the method shown in Figure 1. The first variation comprises making a sub-assembly with fin arrays on both sides and subsequently dividing it into smaller sub-assemblies. The second variation comprises limiting the pattern to that necessary for division, such limitation may for examle be for aesthetic reasons or to reduce tool wear or to maintain fin strength. Figure 11a shows an intermediate stage in the production of one fin array from a length of sheet metal. A pattern of slits and slots has been provided to facilitate subsequent lengthwise division. The pattern comprises a single line of slits and slots. Fins have been formed along part of the continuous length. Figure 11c shows the fin array attached to flat tubes to form a sub-assembly and also shows a second fin array attached to the other side of the flat tubes. Figure 11d shows two sub-assemblies of smaller width obtained by lengthwise division of the sub-assembly of Figure 11c along the lines of slits and slots.

Claims

1. A method of making heat exchanger fin arrays (12) of a variety of different widths and of profiled shape as seen in longitudinal cross section from flat sheet material (10), characterized in that arrays (12) of standard width and of profiled shape as seen in longitudinal cross section are made from flat sheet material (10) of standard width, and the arrays (12) of standard width are subsequently divided lengthwise into arrays of smaller width.

2. A method according to Claim 1, characterized in that the flat sheet material (10) of standard width is provided with a pattern (11) of weaknesses or other physical alterations for facilitating subsequent lengthwise division of the array (12) of standard width and profiled shape.

3. A method according to Claim 2, characterized in that the pattern (11) is repeated across the width of the flat sheet material (10) of standard width to facilitate division into any one of a number of different smaller widths.

4. A method according to Claim 2 or Claim 3 characterized in that the weaknesses (11) include apertures (j) each of which is capable of receiving a jaw of a cutting tool for effecting lengthwise division and is also capable of receiving a mounting bracket (71) or mounting bracket engagement piece (70) for enabling the fin array (12) to be mounted on a wall.

5. A heat exchanger fin array (12) of profiled shape as seen in longitudinal cross section characterized in that the array is provided with a pattern (11) of weaknesses or other physical alterations for facilitating lengthwise division into arrays (12) of smaller width.

6. A method of making heat exchangers of the type comprising mutually parallel co-planar heat exchange elements (13), headers at the end regions of the heat exchange elements, and a fin array (12) which is profiled as seen in longitudinal cross section disposed parallel to the heat exchange elements (13), the method enabling heat exchangers of a variety of different numbers of heat exchange elements (13) and with fin arrays attached to all or only some of the heat exchange elements, to be made, characterized in that a standard number of heat exchange elements (13) are disposed in mutually parallel co-planar relationship, a fin array (12) of standard width which is profiled as seen in longitudinal cross section is attached to the standard number of heat exchange elements (13) thereby making a heat exchange sub-assembly of standard width, the sub-assembly of standard width is divided into sub-assemblies of smaller width by dividing the fin array (12) of standard width lengthwise into smaller widths each with a corresponding smaller number of heat exchange elements (13) attached thereto, the smaller sub-assembly may then be optionally added to further heat exchange elements or to further sub-assemblies to provide the required co-planar arrangement, and headers of appropriate length are then added to the sub-assemblies to form heat exchangers.

7. A sub-assembly for use in making a heat exchanger, the sub-assembly comprising a plurality of mutually parallel co-planar heat exchange elements (13) held in mutually fixed relationship by a fin array (12) which is profiled as seen in longitudinal section and is disposed parallel to the heat exchange elements (13) and joined to each one of them, the fin array (12) being provided with a pattern (11) of weaknesses or other physical alterations for facilitating lengthwise division of the sub-assembly into smaller sub-assemblies.

Revendications

1. Procédé de fabrication de réseaux (12) d'ailettes pour échangeur de chaleur sous une variété de différentes largeurs et de formes profilées, comme il est vu en coupe longitudinale, à partir de matériaux en feuilles plates (10), caractérisé en ce que les réseaux (12) de largeur standard et de forme profilée, comme vu en coupe longitudinale, sont réalisés à partir d'un matériau en feuilles plates (10) de largeur standard, et en ce que les réseaux (12) de largeur standard sont successivement divisés dans le sens de la longueur en réseaux de largeur plus petite.

2. Procédé selon la revendication 1, caractérisé en ce que le matériau en feuilles plates (10) de largeur standard est muni d'une forme (11) d'affaiblissements ou d'autres défauts physiques pour faciliter la division dans le sens de la longueur du réseau (12) de largeur standard et de forme profilée.

3. Procédé selon la revendication 2, caractérisé en ce que la forme (11) est répétée sur la largeur du matériau plat en feuille (10) de largeur standard pour faciliter la division en un nombre quelconque de largeurs différentes.

4. Procédé selon la revendication 2 ou 3, caractérisé en ce que les affaiblissements (11) comprennent des ouvertures (j) dont chacune est susceptible de recevoir une dent d'un outil de découpe pour effectuer la division dans le sens de la longueur et est aussi susceptible de recevoir une bride de fixation (71) ou un élément d'accrochage (70) d'une bride de fixation pour permettre le montage du réseau d'ailettes (12) sur une paroi.

5. Echangeur de chaleur en réseau d'ailettes (12) de forme profilée, comme vu en coupe longitudinale, caractérisé en ce que le réseau est muni d'une forme (11) d'affaiblissements ou d'autres défauts physiques pour faciliter la division dans le sens de la longueur en réseaux (12) de largeur plus petite.

6. Procédé de fabrication d'échangeurs de chaleur du type comprenant des éléments (13) échangeurs de chaleur coplanaires et mutuellement parallèles, des collecteurs aux parties d'extrêmité des éléments (13) échangeurs de chaleur, et un réseau d'ailettes (12) qui est profilé, comme vu en coupe longitudinale, et disposé en parallèle sur les éléments (13) échangeurs de chaleur, le procédé permettant de fabriquer des échangeurs de chaleur d'une variété de différents nombres d'éléments (13) échangeurs de chaleur et avec des réseaux d'ailettes liés à tous ou seulement à certains des éléments (13) échangeurs de chaleur, caractérisé en ce qu'un nombre standard d'éléments (13) échangeurs de chaleur sont disposés en relation coplanaire et mutuellement parallèles, un réseau d'ailettes (12) de largeur standard, qui est profilé comme vu en coupe longitudinale, est lié au nombre standard d'éléments (13) échangeurs de chaleur de façon à fabriquer un sous-ensemble échangeur de chaleur de largeur standard, le sous-ensemble échangeur de chaleur de largeur standard est divisé en sous-ensembles de largeurs plus petites par division des réseaux d'ailettes (12) de largeur standard dans la longueur en largeur plus petite, chacun ayant un nombre correspondant plus petit d'éléments (13) échangeurs de chaleur qui lui sont liés, le sous-ensemble plus petit peut ensuite être ajouté, de façon optionnelle, à d'autres éléments échangeurs de chaleur ou à d'autres sous-ensembles pour produire l'agencement coplanaire souhaité, et des collecteurs de longueurs appropriées sont ensuite ajoutés aux sous ensembles pour former des échangeurs de chaleur.

7. Un sous-ensemble utilisé dans la fabrication d'un échangeur de chaleur, le sous-ensemble comprenant plusieurs éléments (13) échangeurs de chaleur coplanaires et mutuellement parallèles, qui sont maintenus dans une relation de liaison mutuelle fixe par un réseau d'ailettes (12) qui est profilé comme vu selon la coupe longitudinale et est disposé parallèlement aux éléments échangeurs de chaleur (13) et lié à chacun d'eux, le réseau d'ailettes (12) étant muni d'une forme (11) d'affaiblissements ou d'autres défauts physiques pour faciliter la division dans le sens de la longueur du sous-ensemble en sous-ensembles plus petits.

Patentansprüche

1. Verfahren zur Herstellung von Wärmetauscher-Rippenmatrizen (12) mit einer Vielzahl von verschiedenen Breiten und mit Profilform im longitudinalen Querschnitt aus flachem Blechmaterial (10), **dadurch gekennzeichnet**, daß Matrizen (12) mit Standardbreite und in Profilform im longitudinalen Querschnitt aus flachem Blechmaterial (10) einer Standardbreite hergestellt werden und daß die Matrizen (12) mit Standardbreite nachfolgend in Längsrichtung in Matrizen kleinerer Breite zerteilt werden.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das flache Blechmaterial (10) mit Standardbreite mit einem Muster (11) von Sollschwachstellen oder anderen körperlichen Veränderungen versehen wird, um nachfolgend die längsweise Teilung der Matrix (12) mit Standardbreite und Profilform zu vereinfachen.

3. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß das Muster (11) über die ganze Breite des flachen Blechmaterials (10) wiederholt wird, um die Teilung in irgendeine einer Anzahl von verschiedenen kleineren Breiten zu vereinfachen.

4. Verfahren nach Anspruch 2 oder nach Anspruch 3, dadurch gekennzeichnet. daß die Schwachstellen (11) Öffnungen (j) umfassen, wobei jede dieser dazu geeignet ist, eine Backe eines Schneidwerkzeuges zur längsweisen Teilung aufzunehmen, und ebenso dazu geeignet ist, eine Befestigungsklammer (71) oder ein Befestigungsklammereingreifelement (70) aufzunehmen, um es der Rippenmatrix (12) zu ermöglichen, an einer Wand befestigt zu werden.

5. Wärmetauscher-Rippenmatrix (12) einer Profilform in longitudinalem Querschnitt, **dadurch gekennzeichnet**, daß die Matrix mit einem Muster (11) von Sollschwachstellen oder anderen körperlichen Veränderungen versehen ist, um die längsweise Teilung in Matrizen (12) kleinerer Breite zu vereinfachen.

6. Verfahren zur Herstellung von Wärmetauschern des Typs mit wechselweise parallelen koplanaren Wärmetauscherelementen (13), mit Kopfstücken an den Endbereichen der Wärmetauscherelemente und mit einer Rippenmatrix (12), die in longitudinalem Querschnitt profiliert parallel zu den Wärmetauscherelementen (13) angeordnet ist, wobei das Verfahren die Herstellung von Wärmetauschern einer Vielzahl von verschiedenen Anzahlen von Wärmetauscherelementen (13) und mit Rippenmatrizen gestattet, die mit allen oder nur einem Teil der Wärmetauscherelemente verbunden sind, **dadurch gekennzeichnet**, daß eine Standardanzahl von Wärmetauscherelementen (13) in wechselweise parallel koplanarer Beziehung angeordnet sind, daß eine Rippenmatrix (12) mit Standardbreite, die in longitudinalem Querschnitt ein Profil aufweist, an der Standardanzahl von Wärmetauscherelementen (13) befestigt wird, um dadurch eine Wärmetauscher-Untergruppe mit Standardbreite zu schaffen, wobei die Untergruppe mit Standardbreite in Untergruppen kleinerer Breite aufgeteilt wird, indem die Rippenmatrix (12) mit Standardbreite in Längsrichtung in kleinere Breiten zerteilt wird, wobei an diesen jeweils eine zugehörige kleinere Anzahl von Wärmetauscherelementen (13) befestigt wird, daß die kleinere Untergruppe dann wahlweise zu weiteren Wärmetauscherelementen oder zu weiteren Untergruppen hinzugefügt werden kann, um die benötigte koplanare Anordnung zu schaffen, und daß dann Kopfstücke geeigneter Länge zu den Untergruppen hinzugefügt werden, um Wärmetauscher zu bilden.

7. Untergruppe zur Benutzung in der Herstellung von einem Wärmetauscher, mit einer Vielzahl von wechselweise parallelen koplanaren Wärmetauscherelementen (13), die in gegeneinander feststehendem Verhältnis durch eine Rippenmatrix (12) gehalten werden, die in longitudinalem Querschnitt profiliert und parallel zu den Wärmetauscherelementen (13) ausgerichtet und mit jedem von diesen verbunden ist, wobei die Rippenmatrix (12) mit einem Muster (11) von Sollschwachstellen oder anderen körperlichen Veränderungen versehen ist, um die längsweise Teilung der Untergruppe in kleinere Untergruppen zu vereinfachen.

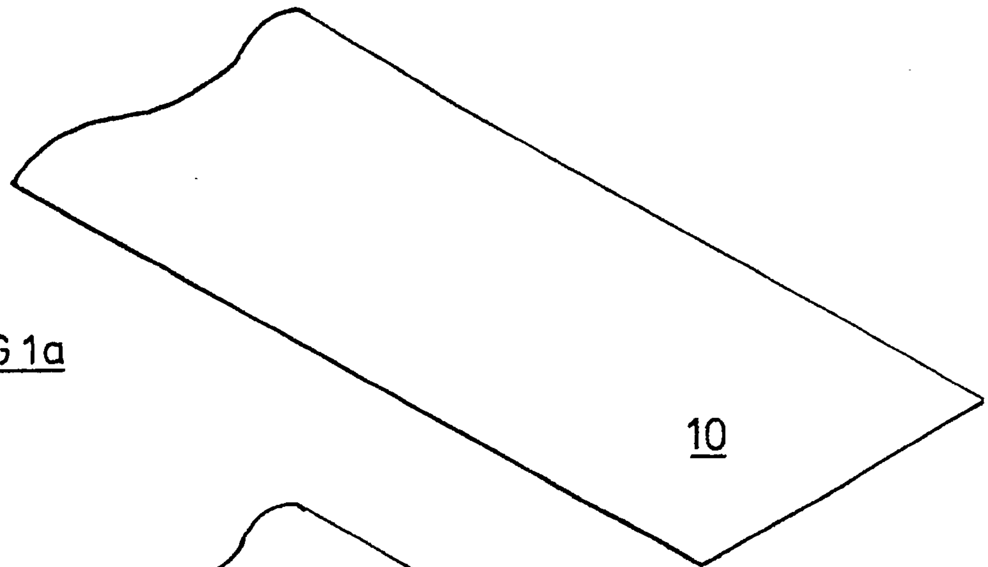


FIG 1a

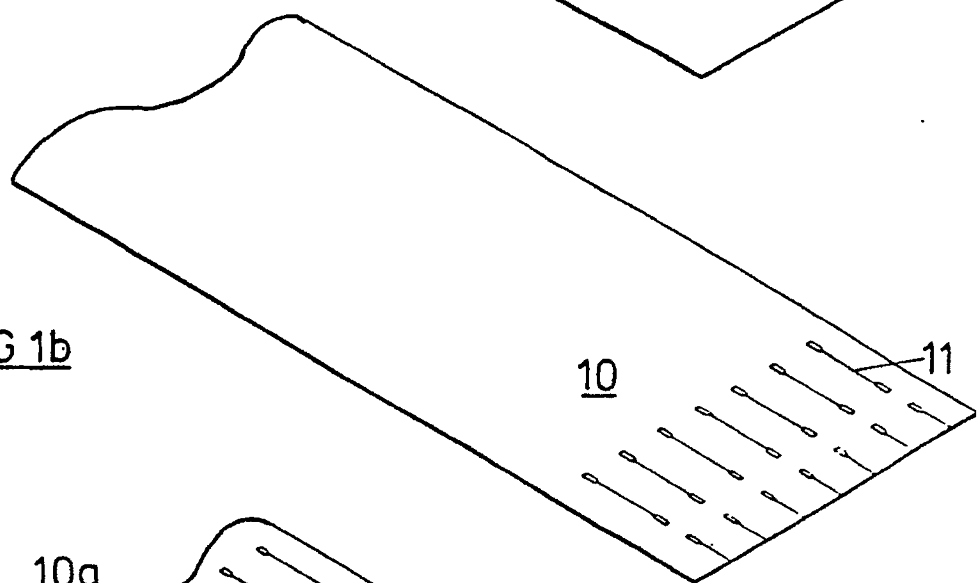
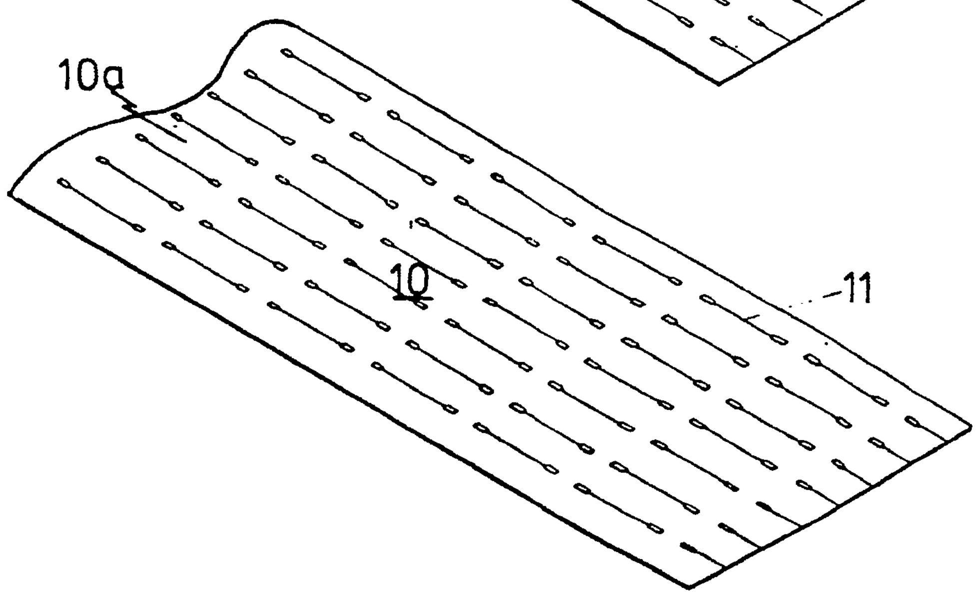


FIG 1b



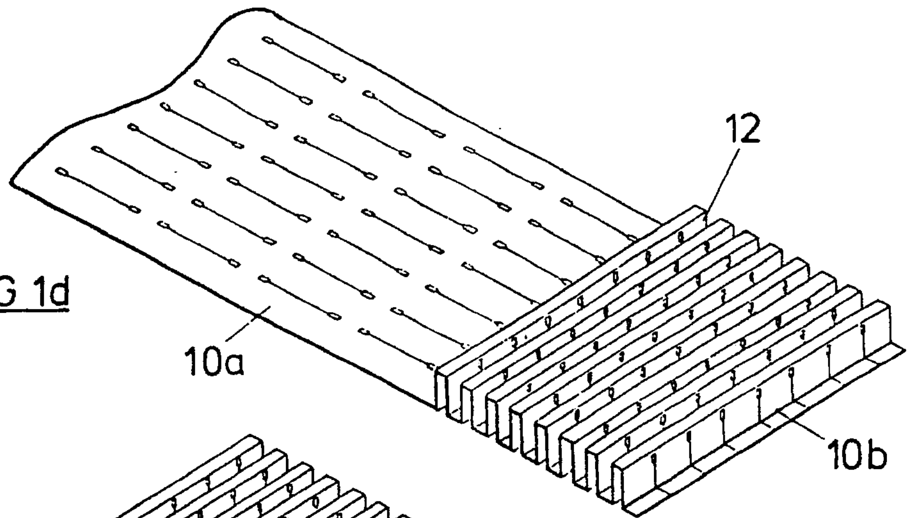


FIG 1d

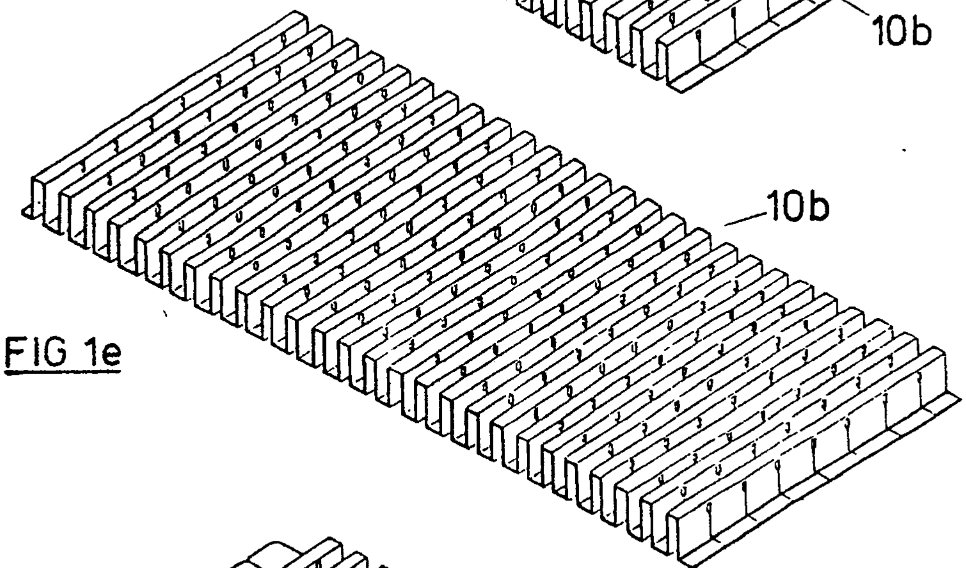


FIG 1e

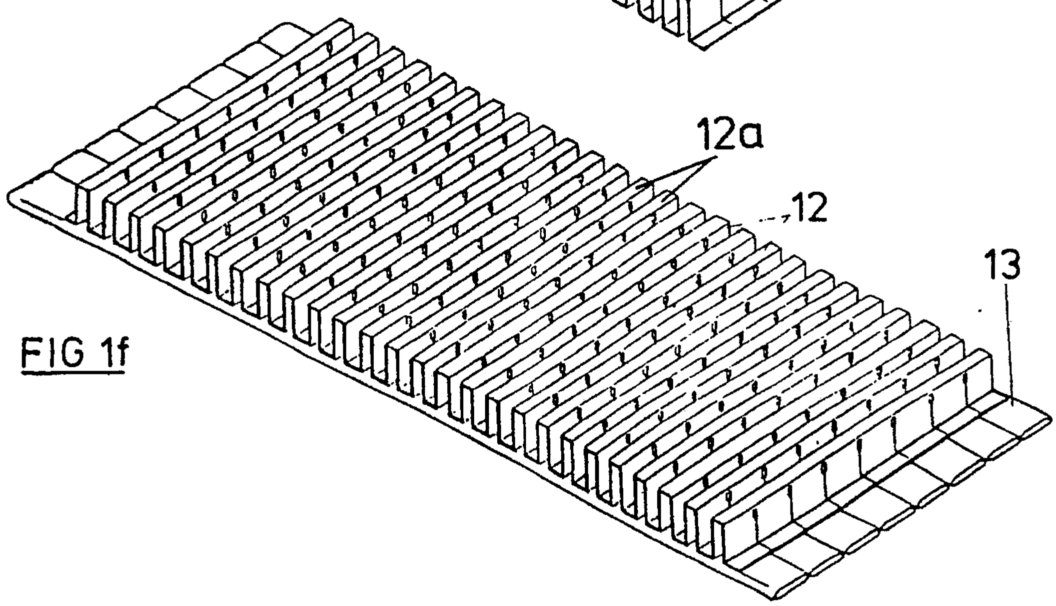


FIG 1f

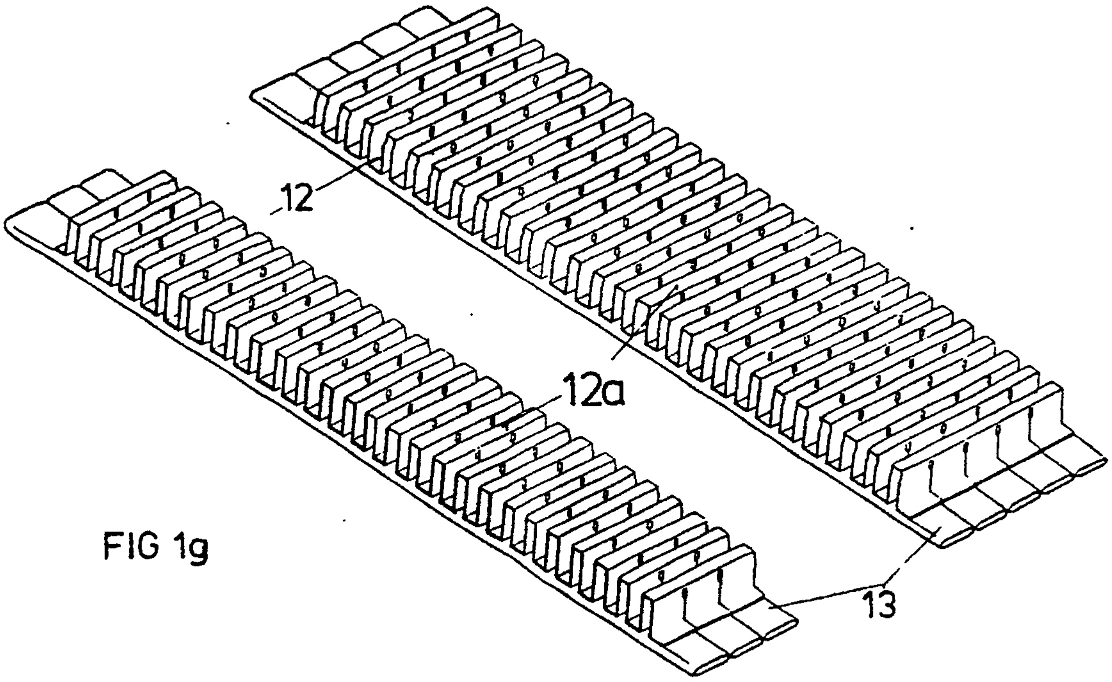


FIG 1g

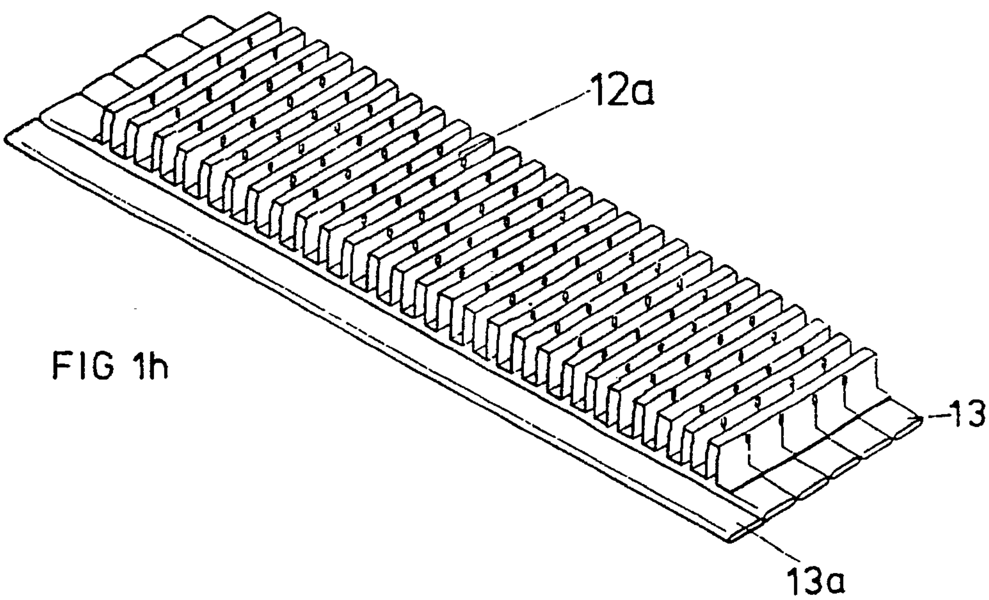


FIG 1h

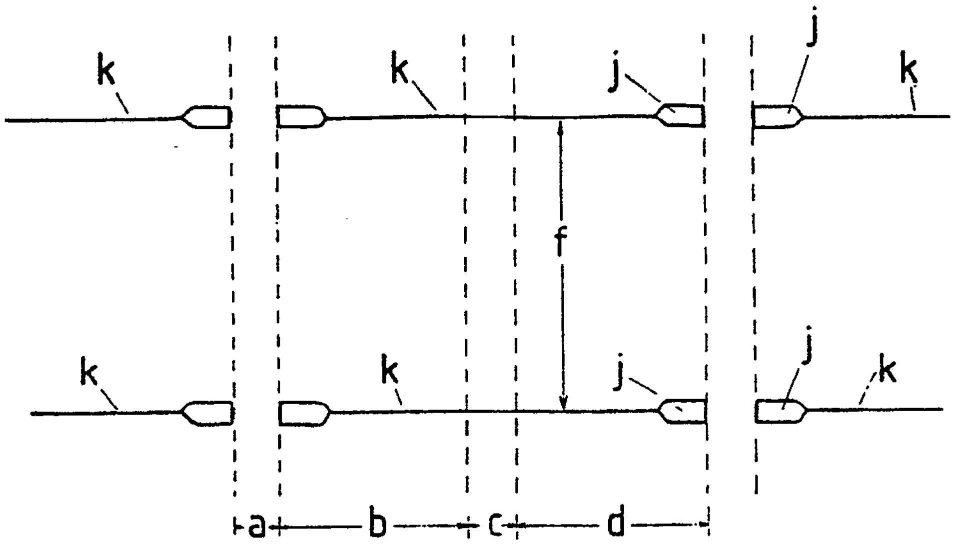


FIG 2a

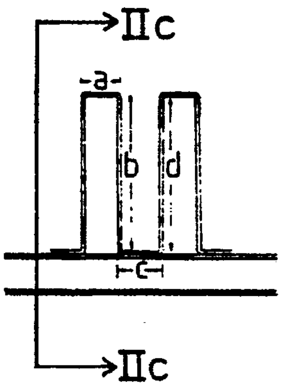


FIG 2b

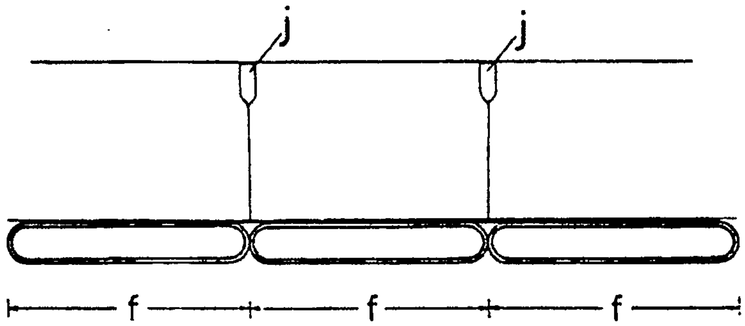


FIG 2c

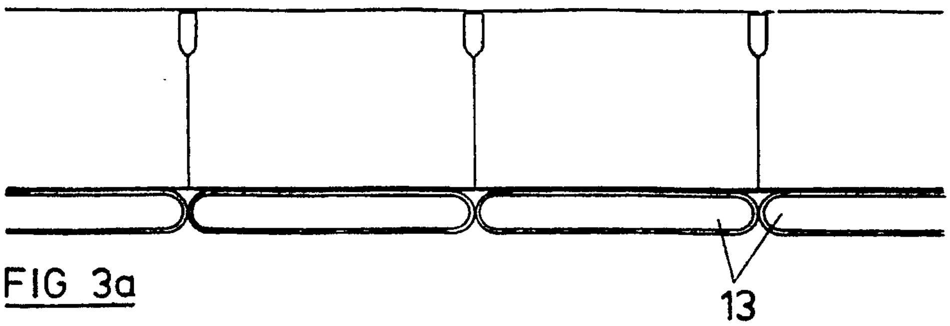


FIG 3a

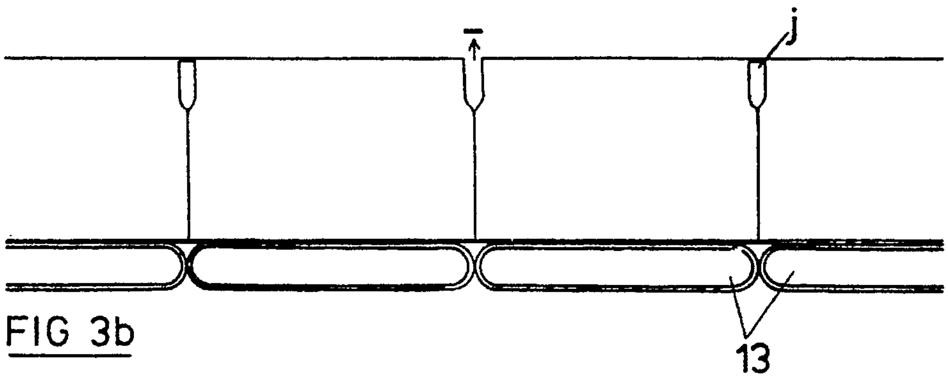


FIG 3b

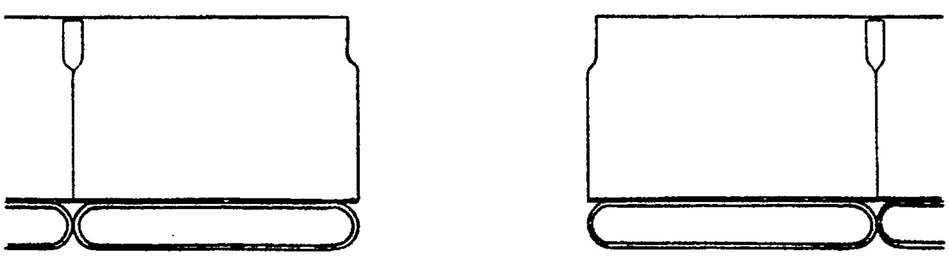


FIG 3c

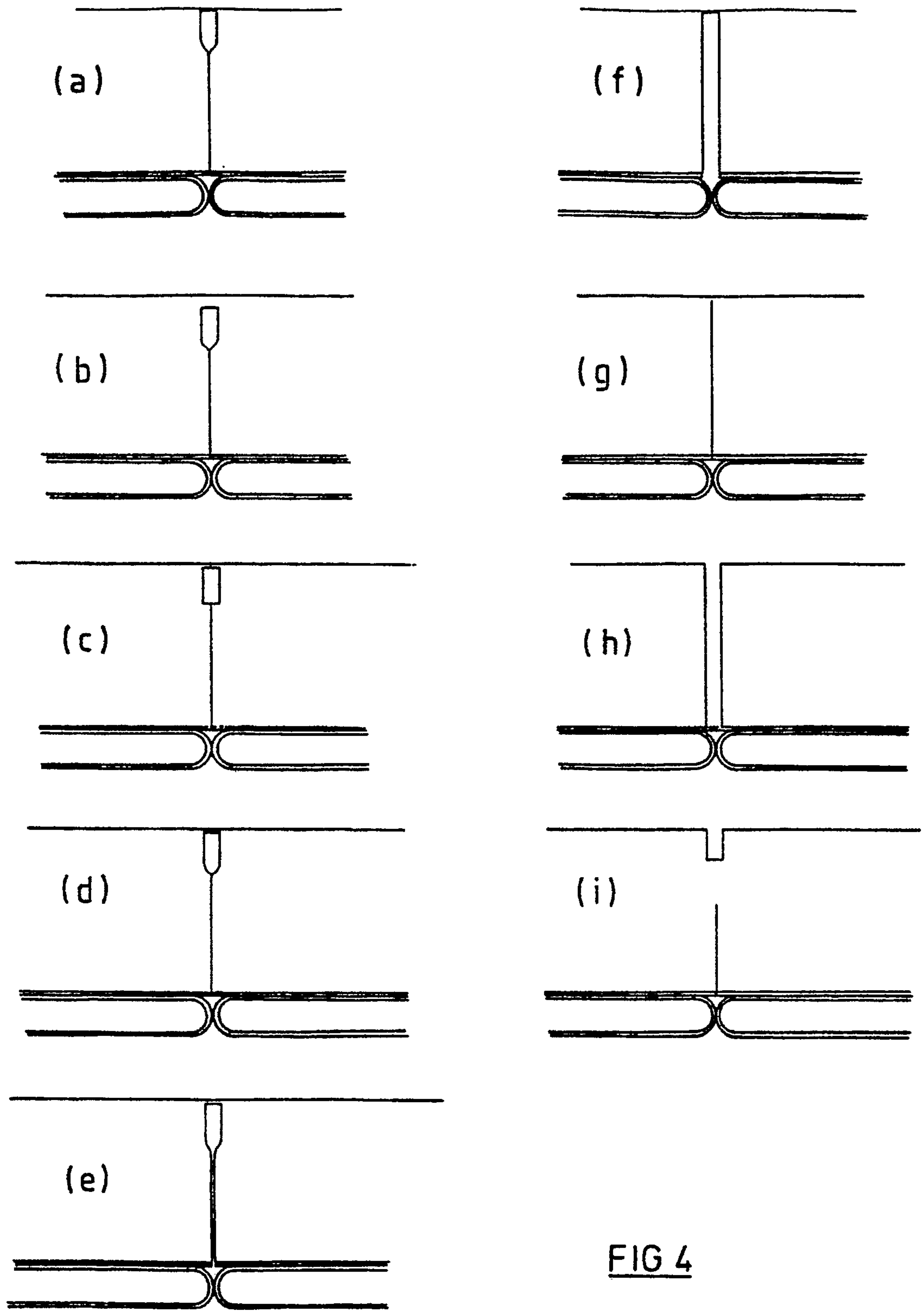


FIG 4

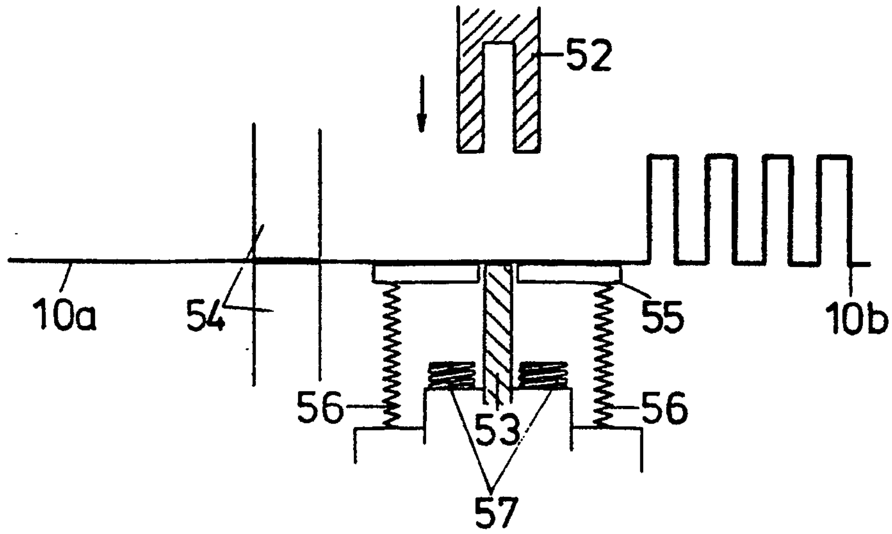


FIG 5a

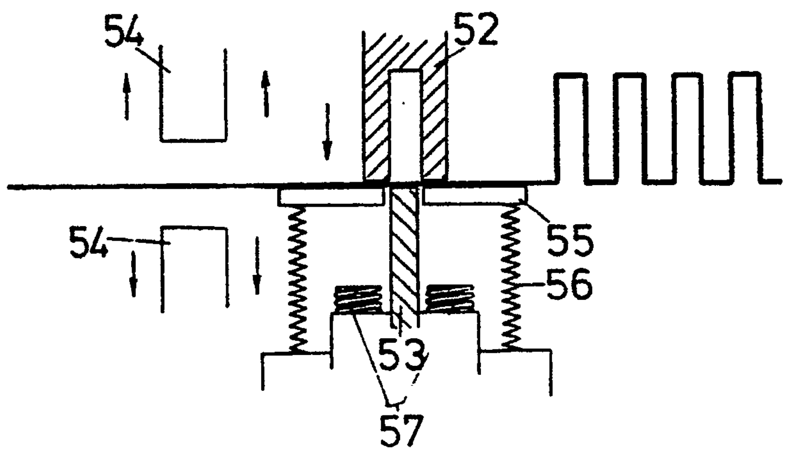


FIG 5b

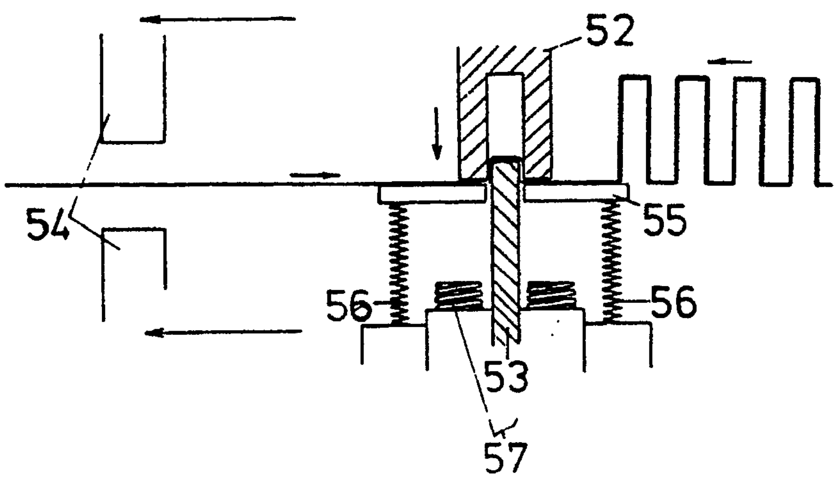


FIG 5c

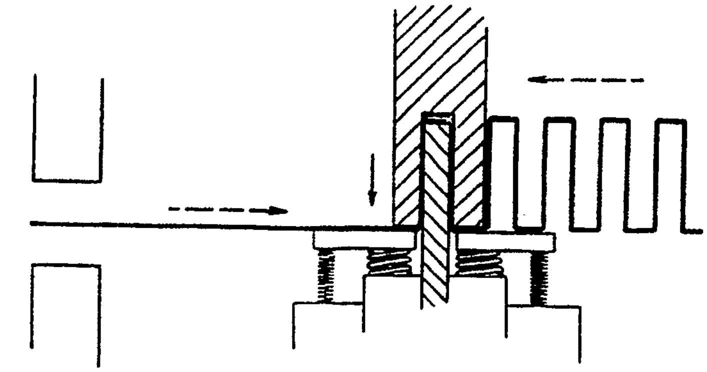


FIG 5d

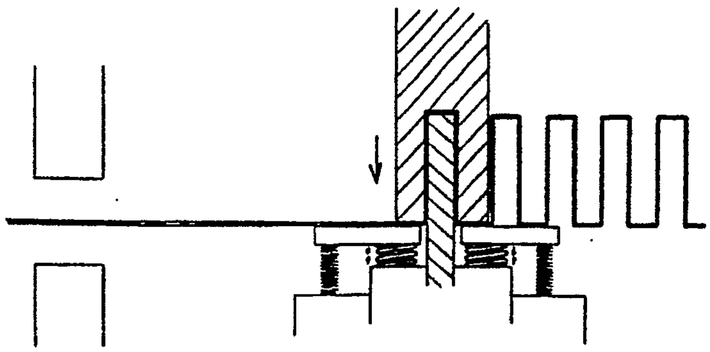


FIG 5e

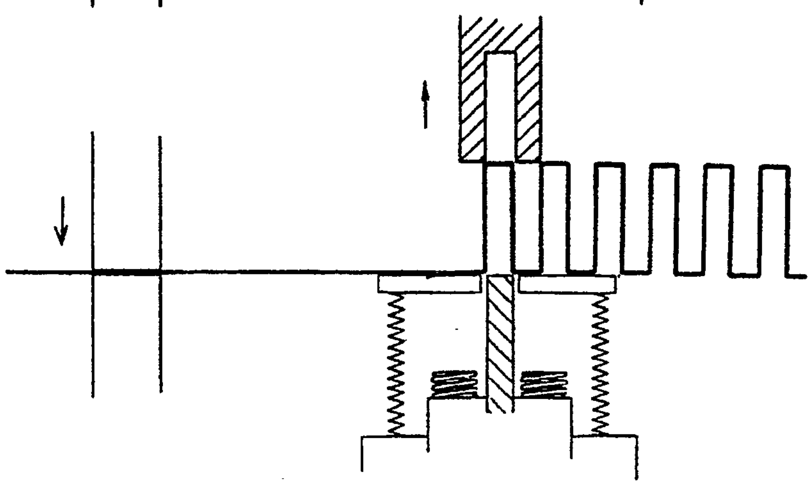


FIG 5f

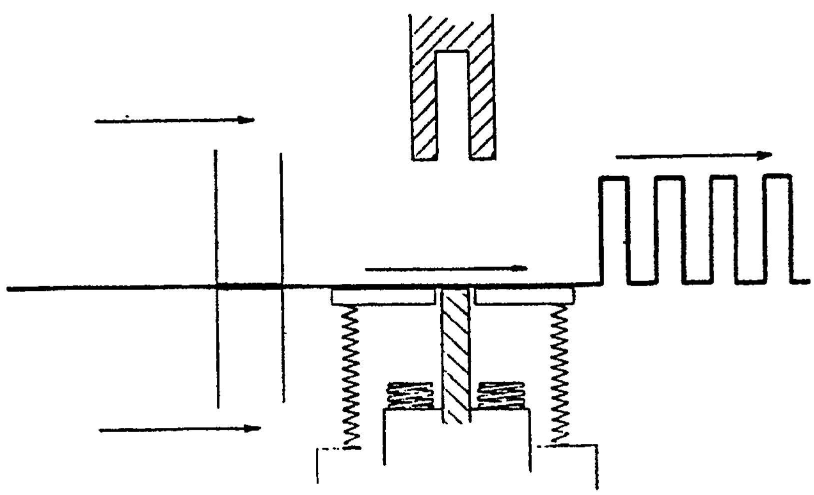


FIG 5g

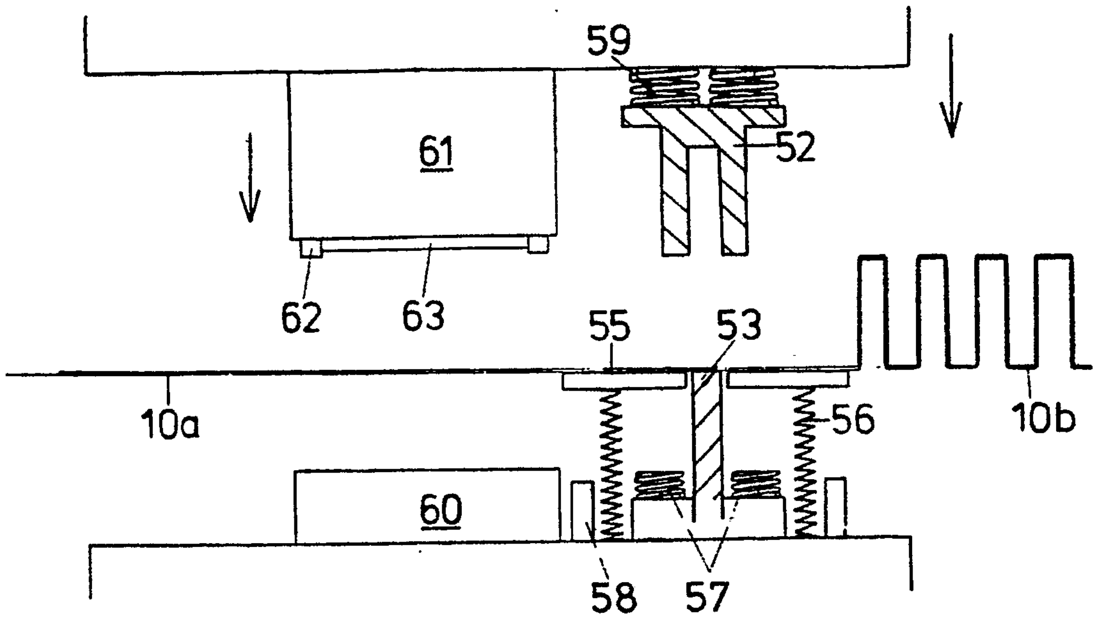


FIG 6a

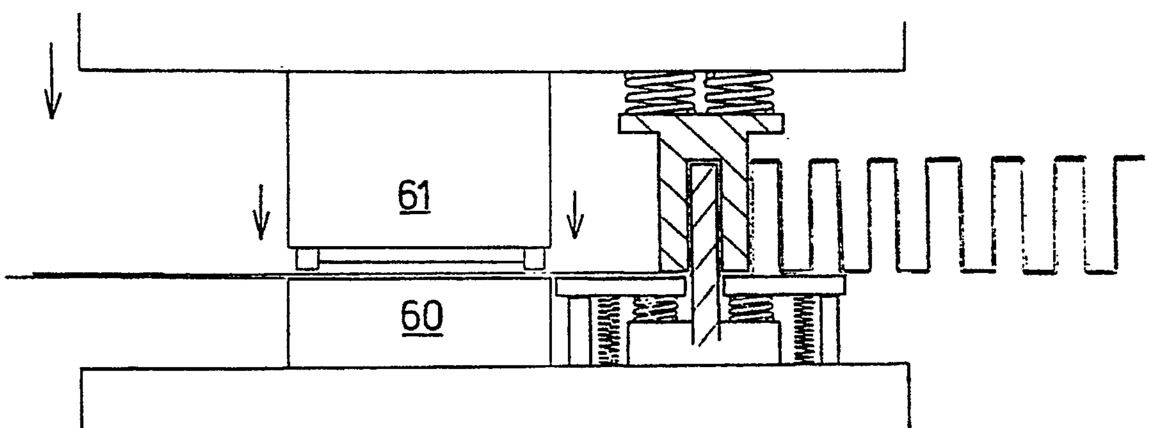


FIG 6b

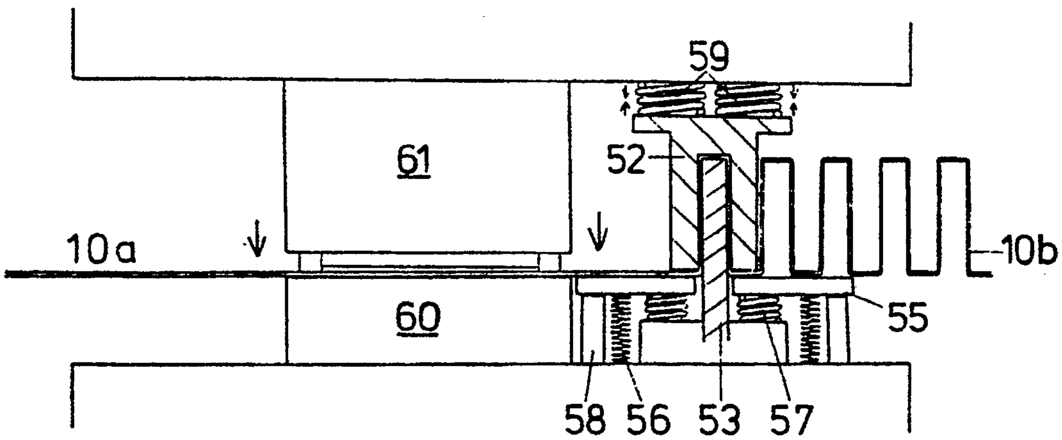


FIG 6c

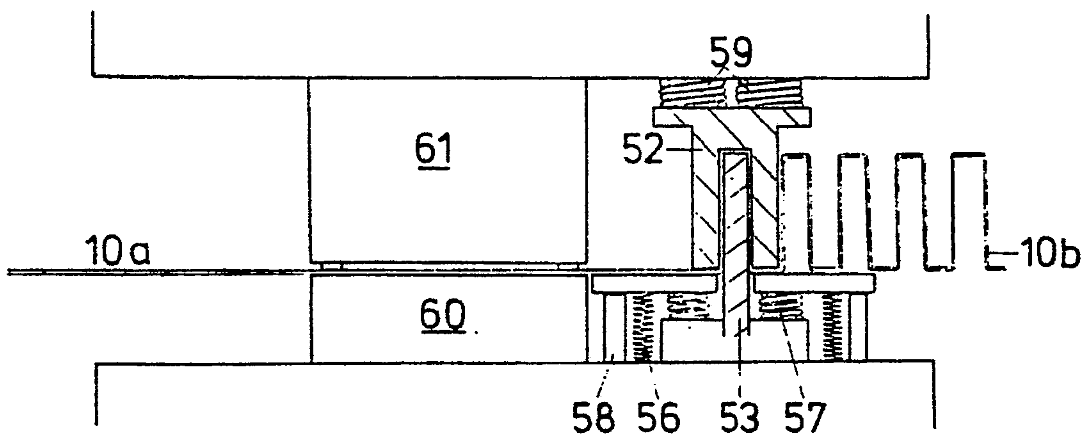


FIG 6d

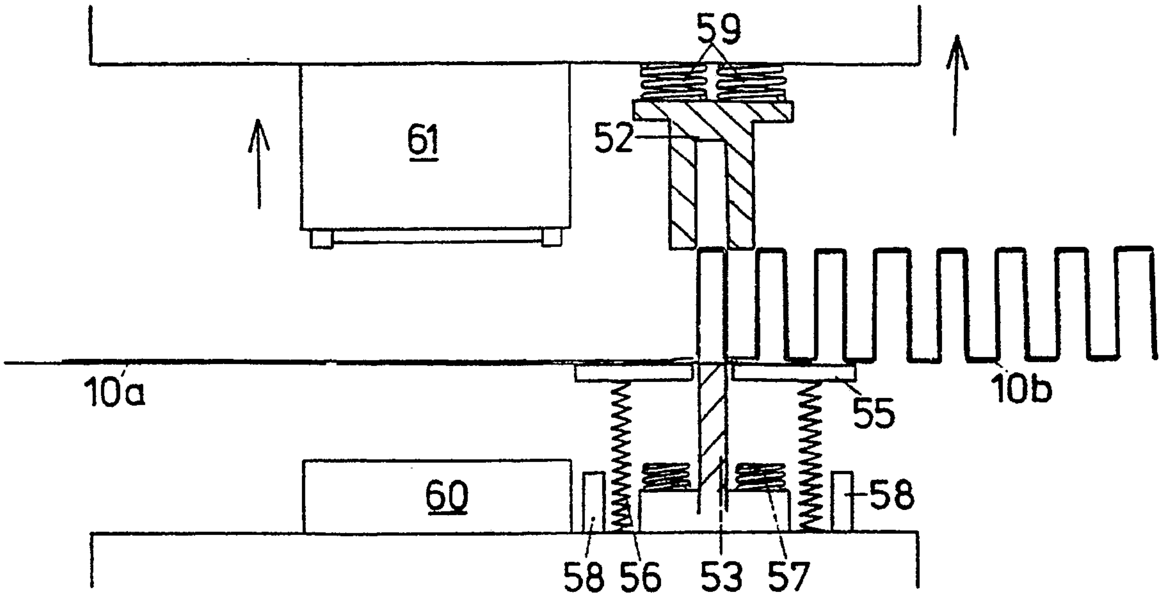

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FIG 6e

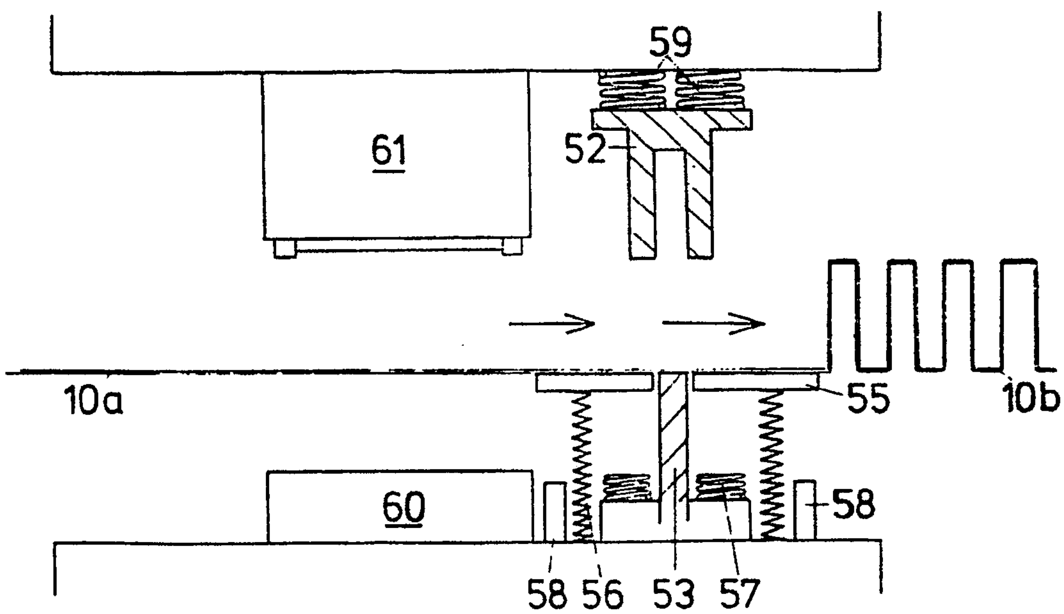
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FIG 6f

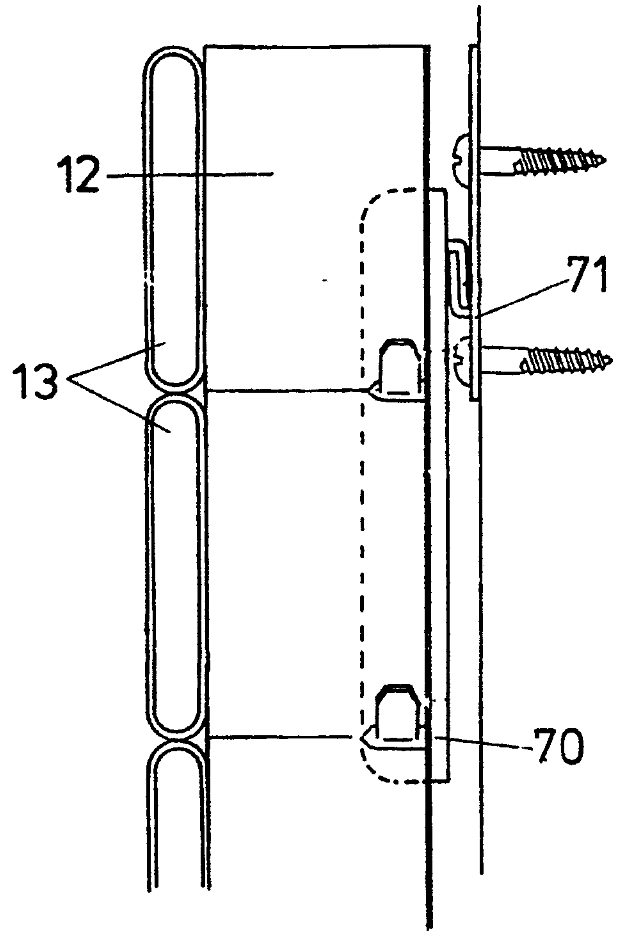


FIG 7a

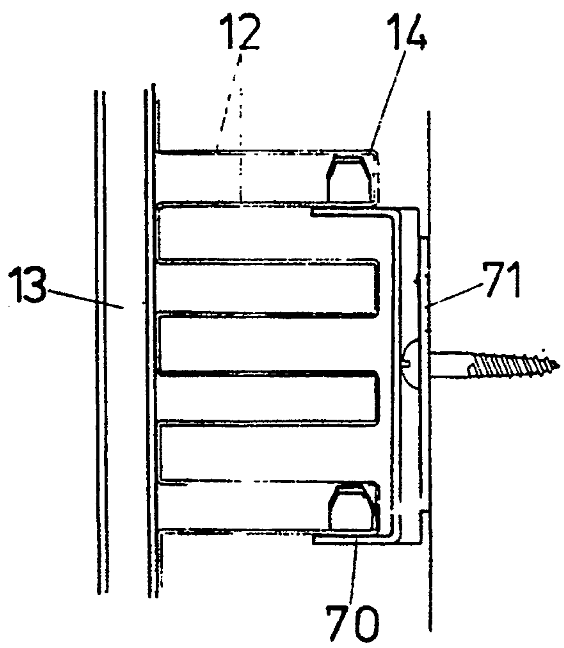


FIG 7b

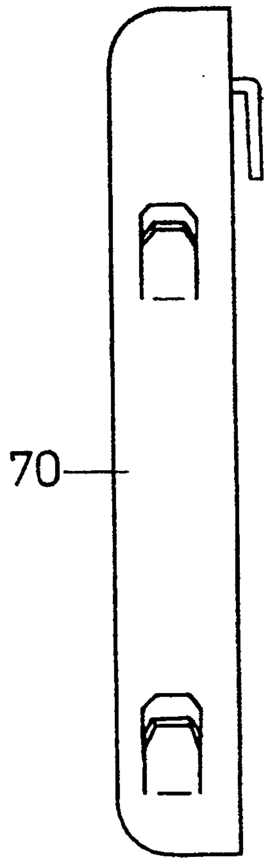


FIG 8a

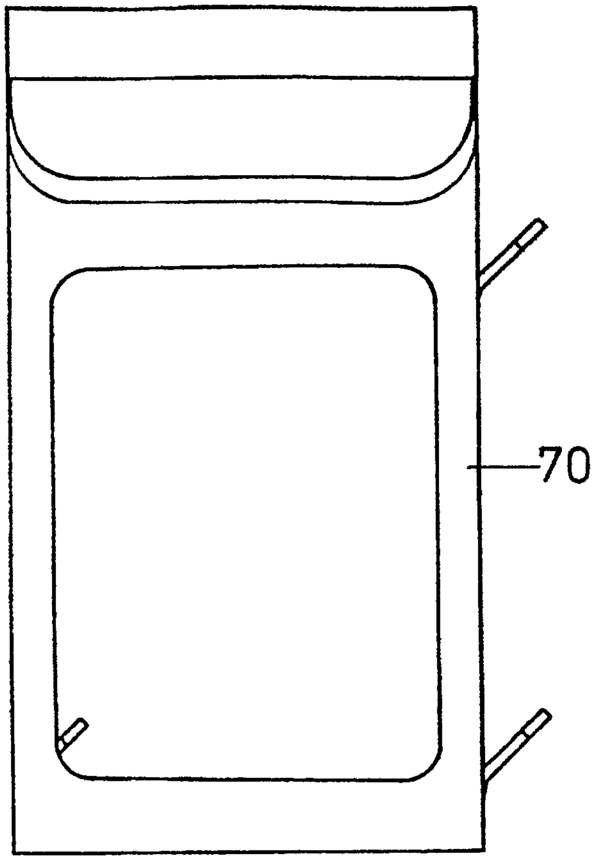


FIG 8b

FIG 8c

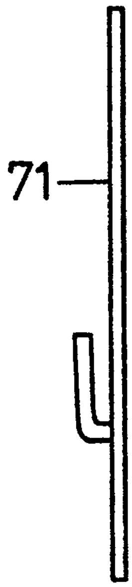


FIG 9a

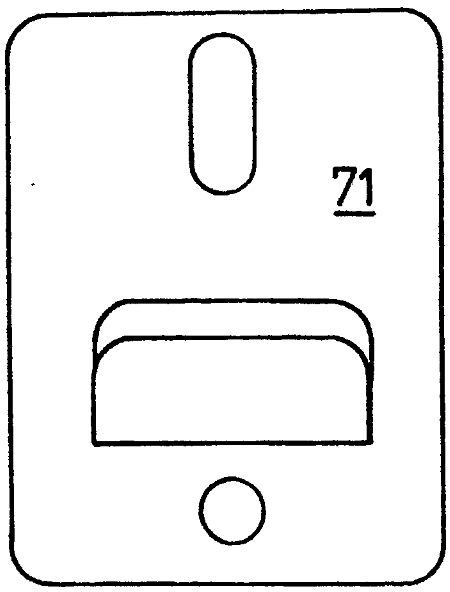


FIG 9b

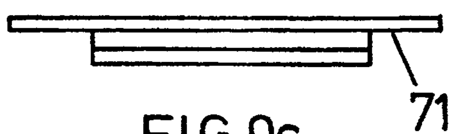


FIG 9c

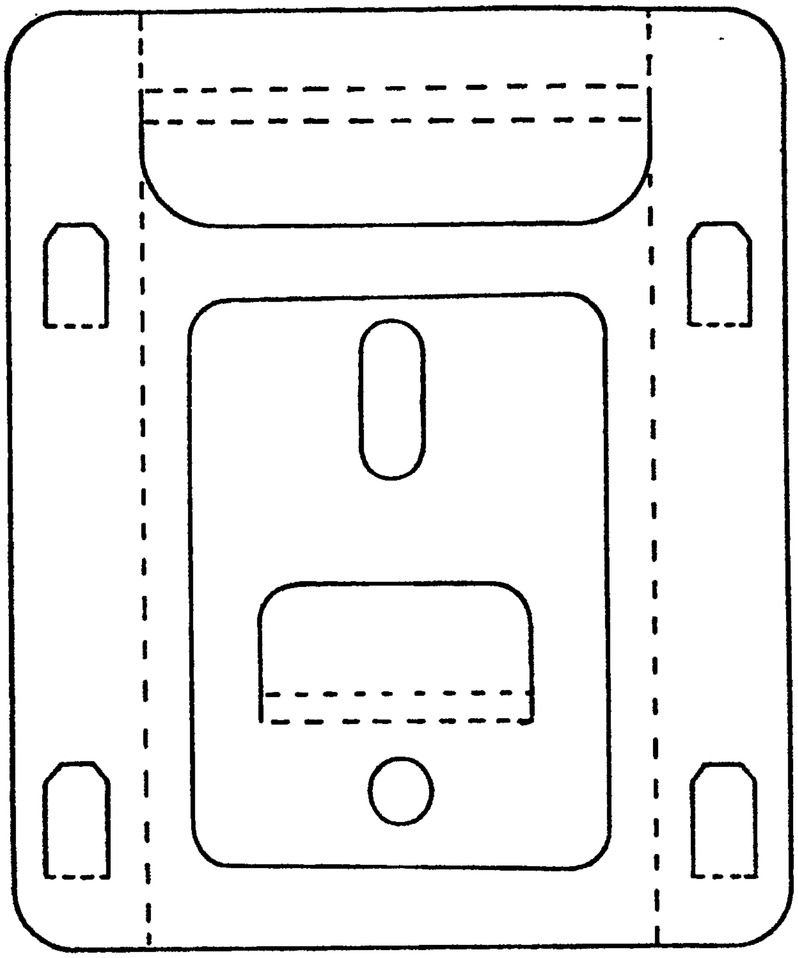
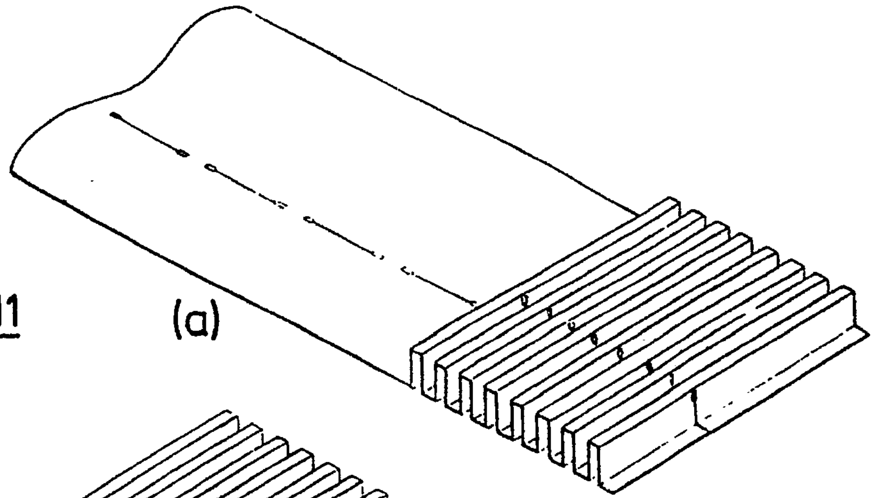


FIG 10

FIG 11



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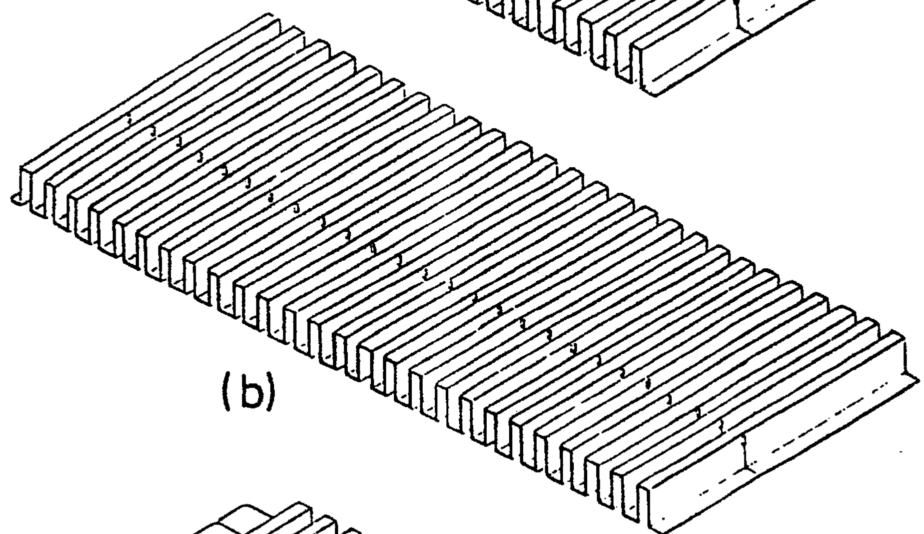

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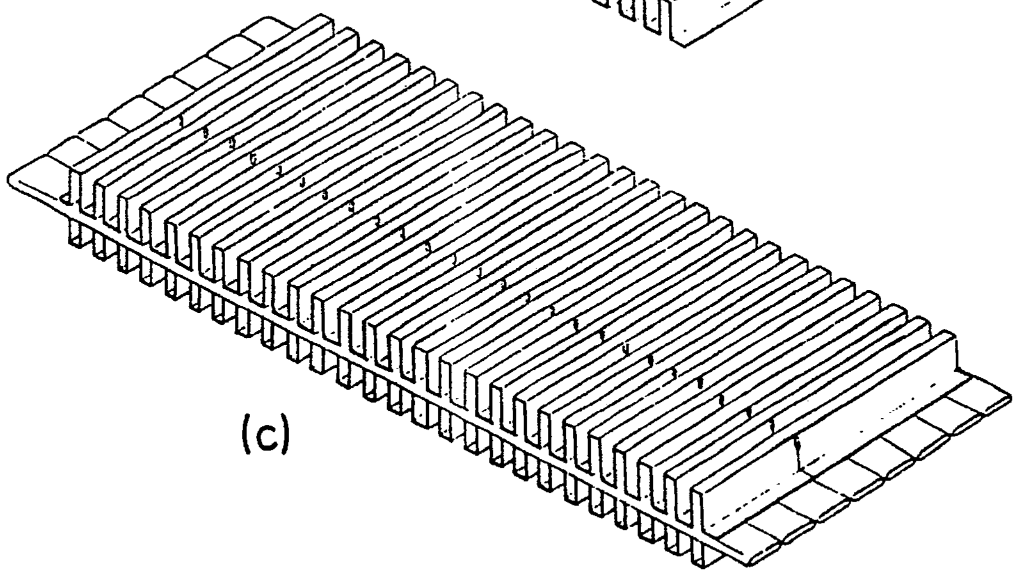
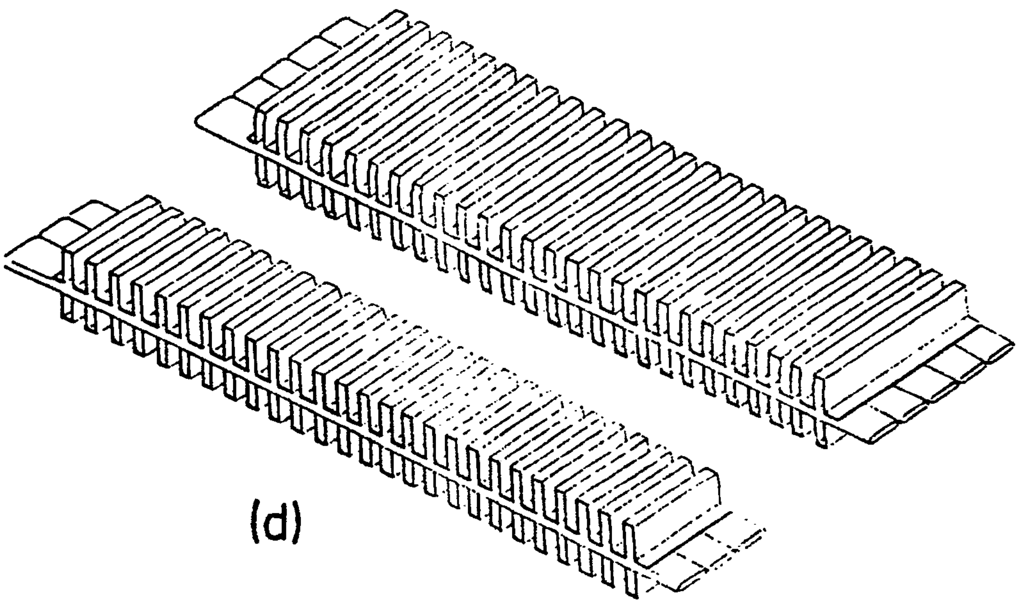


(c)

FIG 11



(d)