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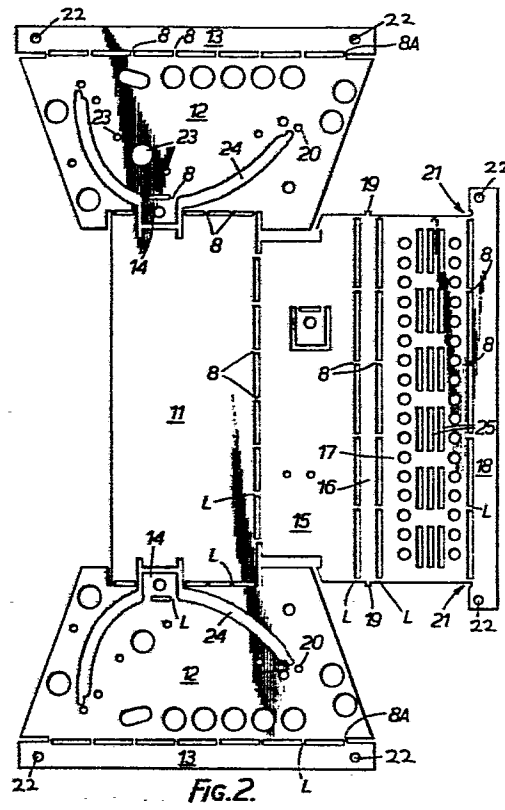
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(54) Improvements in or relating to luminaires and the manufacture thereof.

(57) At least one structural component of a luminaire, for example a floodlight housing or a top baffle of a spotlight, is made by providing one or more sheet metal blanks, punching apertures in the blank(s) to define lines of weakness (L) therein, bending the blank(s) along lines of weakness and securing together different parts of the blank(s) that, after bending, are next to one another to retain the blank(s) in their correctly formed position.



This invention relates to luminaires and the manufacture thereof. In particular the invention is concerned with theatre, television and film luminaires, for example floodlights.

5           A luminaire may include a metal housing to which various parts, in particular, the lenses, lamp and the reflector are secured. The exact nature of the housing will vary from one luminaire to another and in some cases there may be one or more structural components  
10 in addition to or instead of the housing; for example, a spotlight may have side walls a base and a top baffle member all made up of different structural components secured together. In the case of a floodlight the housing may be of box like shape with one side of the  
15 box translucent; in this case the floodlight may have a tubular lamp extending across the box and located in opposite sides of the housing and a reflector behind the lamp also located in channels in the side of the housing and these channels may be shaped to the required  
20 curve of the reflector.

          There are various ways in which such structural components of the luminaire can be made. For example, each part of the component can be made as a separate part and the various parts bolted, welded or riveted  
25 together; another possibility is to press the component out of a blank sheet using a mechanical press and subsequently machine the component to provide the

necessary mounting holes and/or slots.

These methods, however, are quite time consuming and correspondingly expensive. They also do not permit even minor modifications in the design of the component  
5 without substantial modification to the process.

According to the invention there is provided a method of making a luminaire in which at least one structural component of the luminaire is made by providing one or more sheet metal blanks punching apertures in the one or  
10 more blanks to define lines of weakness therein, bending the one or more blanks along the lines of weakness, and securing together different parts of a blank or parts of different blanks that, after bending, are next to one another to retain the blank or blanks in their correctly formed  
15 position.

All the holes, formations, inserts or slots that are required in the component can be formed in the blank before bending. All apertures in the blank can be formed by punching using selected punches of a predetermined set.  
20 Machines for carrying out such punching operations according to a preselected program are commercially available. If desirable in a particular case other elements to be attached to the final component or formed into it can be added to the blank at this stage. All that is then required is for a  
25 person and/or machine to assemble the blank by bending it along the lines of weakness. The location of the lines of weakness is dictated by the punching of the blank which can

easily be varied by changing the machine program. Thus it can be made very simple to switch from manufacture of one component to manufacture of another component which is similar but slightly different from the first and  
5 which for example is intended for a different size of luminaire; apart from varying the punching, all that is required is for the assembler to be familiar with each of the bending patterns. The process is particularly suitable for the manufacture of theatre luminaires and the like and  
10 for example it is a simple process to punch an optical curve for a reflector in the blank and thereafter to adjust the optical curve. An optical curve may be punched by punching a series of small diameter holes along the outline of the optical curve.

15           The dimension of an aperture perpendicular to its associated line of weakness is preferably between 80 per cent and 250 per cent of the thickness of the sheet metal blank. These relative dimensions are important since they influence the ease with which the blank can be bent success-  
20 fully. If this dimension of an aperture is too small then the material will tend to tear during bending; if this dimension of an aperture is too big then the actual line along which bending will take place cannot be accurately predicted and accurate assembly cannot be guaranteed. Most preferably  
25 the dimension of an aperture perpendicular to its associated line of weakness is between 100 per cent and 180 per cent of the thickness of the sheet metal blank. With these relative

dimensions appropriately selected the blank can easily be bent very accurately so that for example holes in juxtaposed parts of the bent blank are accurately aligned or other features fall in a precise predetermined relationship to one another.

The selection of the relative lengths along the lines of weakness of apertures and bridging portions is less critical and depends on how much force is desirable to bend the blank. A length for the bridging portions of between about 150 and 250 per cent of the thickness of the sheet metal blank is preferred.

The bending of the blank can be carried out by hand. At first sight such a procedure might seem disadvantageous but if the blank is assembled by a person then it becomes very easy to switch from one bending pattern to another.

The different parts of the blank or parts of different blanks may be secured together by interlocking formations in the blank. In this way it is possible to make a strong three dimensional structural component without the use of any ancillary fastening devices.

Preferably the angle of bending about a line of weakness is defined by the interengagement of different parts of a blank or parts of different blanks. In this case a rigid structure is produced and also assembly may be simplified as the angle of bending is defined for the assembler.

According to another aspect of the invention there

is provided a luminaire including at least one structural component which is made from one or more sheet metal blanks which has or have been bent along lines of weakness defined by apertures formed in the blank or blanks to form a three dimensional structural component, different parts of a blank or parts of different blanks being next to one another after bending and being secured together to retain the blank or blanks in their correctly formed position.

At least one of the lines of weakness may be formed by a plurality of apertures spaced along the line of weakness. The use of a plurality of apertures gives the final component more strength perpendicular to the line of weakness than if a single aperture contained within two bridging portions were provided.

The apertures may be in the form of elongate openings. At least one of the lines of weakness may be formed by a series of slots, the slots being separated by narrow bridging portions. The edges of a slot may be straight or curved. While elongate openings are preferred for the apertures, they may be of circular or other cross-sections.

In order to vary the final form of the housing all that is necessary is to change the initial form of the sheet metal blank. Thus for example the optical curve of the reflector may easily be adjusted. By making the blank on a program controlled machine, changes of this kind can be made simply by changing the program of the machine. Holes, formations, inserts or slots can readily be made in or on

the sheet metal blank and optical curves may also be punched by punching a series of small diameter holes along the outline of the optical curve.

By way of example, certain illustrative embodiments of the invention will now be described with reference to the accompanying drawings, of which:

Figure 1 is a perspective view of a floodlight embodying the invention,

Figure 2 is a plan view of a sheet metal blank from which the floodlight housing is formed,

Figure 3 is a rear view of the floodlight housing,

Figure 4 is a side sectional view of the floodlight housing,

Figure 5 is a plan view of a sheet metal blank from which a part of the floodlight casing is formed,

Figure 5A is a side sectional view of the floodlight casing,

Figure 6 is a perspective view of a spotlight embodying the invention and including a top baffle member formed from a metal blank,

Figure 7 is a side view (partly in section) of the top baffle member,

Figure 8 is an end view of the top baffle member,

Figure 9 is a plan view of a sheet metal blank from which the top baffle member is formed, and

Figure 10 is a diagram showing where the sheet metal is punched to form the blank of Figure 9.



The floodlight shown in Figure 1, has a housing 1 in which a strip lamp 2 and a reflector 3 are mounted. The housing 1 is located in an outer casing 4 to which a yoke 5 is attached. The yoke 5 is pivotally mounted on the casing 4 and can be clamped in a desired position by tightening a knob 6 mounted on the yoke 5. Ventilation slots 7 are provided in the top of the casing 4.

The housing 1 is made from a sheet metal blank shown in Figure 2. The method by which a blank of this kind can be made will be known to those skilled in the art. A preferred method of making the blank is to punch out the various holes and slots shown on a machine tool having multiple punch tools for punching out the various shapes, the positioning of the blank relative to the tool head and the selection of the punch tool used in the punching operation, being selected according to a control program fed into the machine, for example on a paper tape. The use of a tool of this kind makes it particularly easy to alter the shape of the blank if the final form of housing is to be modified. The arcuate slots in the blank, which as will be explained later define the optical curve for the reflector 3, are formed by punching a series of small holes along the outline of the curve. Consequently, the shape of the optical curve can also be changed very easily which is a particular advantage of the process embodying the invention.

The sheet metal blank includes lines of weakness defined by a series of slots along those lines, the slots

being separated by bridging portions 8. These lines of weakness are the lines along which the blank is folded or bent.

5 More specifically the blank has a central part 11; connected at opposite ends to sides 12 which each have a flange part 13 and a tab 14 attached thereto. Along one side edge, part 11 is connected to a lower part 15 connected in turn to a locking bar 16, which in turn is connected to a ventilated base part 17 carrying a flange  
10 part 18. Between each adjoining pair of parts there is a line of weakness L in the blank which is sufficiently weak that it can be bent by hand (without the aid of any kind of tool).

The blank may for example be made of an aluminium  
15 alloy or steel and thicknesses in the range of 1 to 3 mm are satisfactory.

The assembly of the blank into the housing 1 will now be described with reference to Figures 2 to 4.

The flange parts 13 are first folded downwards  
20 perpendicular to the sides 12.

The parts 11, 15, 16, 17 and 18 are then folded into approximately the position shown in section in Figure 4. Thus the parts 11, 15 and 16 are folded inwards and parts 17 and 18 folded outwards.

25 Part 15 is first bent relative to part 11. If a suitable aluminium alloy material exhibiting significant work hardening is employed, then the relative bends

between parts 15, 16 and 17 can be accomplished by an operator first holding part 18 and bending it relative to part 15 to achieve the desired bend between parts 15 and 16 and subsequently holding part 18 and bending it back relative to part 15 to achieve the desired bend between parts 16 and 17. In the first bending step deformation takes place along the line of weakness between parts 15 and 16 since this line of weakness suffers the greatest bending moment; for the subsequent step, however, the bent bridge portions are work hardened so that, with little or no encouragement from the assembler, deformation takes place along the line of weakness between the parts 16 and 17.

The sides 12 are folded upwards perpendicular to the part 11 and the tabs 14 folded outward perpendicular to the sides 12. The various parts are then locked together into a rigid three dimensional structure by locating projections 19 at each end of the bar 16 in holes 20 in the sides 12 and by interlocking grooves 21 at opposite ends of the flange part 18 with bridging portions 8A at respective ends of the lines of weakness between flange parts 13 and sides 12.

The assembled housing 1 has four mounting holes 22 (Figure 3) by which it can be fastened to the casing 4, two sets of holes 23 for receiving a strip light fitting, a pair of curved slots 24 for mounting the reflector 3 with the desired optical curve and ventilating slots 25 to allow a convected air flow through the casing (the top of the housing 1 is open).

The tabs 14 are not fastened to the casing but abut seats provided by the casing which limit outward movement of the housing sides when a lamp is fitted in the housing.

5           While the description above relates to the manufacture of the housing it will be appreciated that other parts of the luminaire could be made by the techniques described above.

10           Figure 5 shows the blank that is used to make the side of the casing on which the part of the yoke 5 carrying the knob 6 is mounted. The blank shares many common features with the blank shown in Figure 2 for example lines of weakness 1 defined by discontinuous slots bridged by bridging portions 8 are provided. Two features of the blank of  
15           Figure 5 which are not present in the blank of Figure 2 will be described.

          First an internally screw threaded bush 26, or a formed constriction for use with a self threading fastener, is added to the middle of the blank. Once the blank is  
20           formed into its final shape and defines part of the luminaire casing, this bush provides a mounting both for the yoke 5 and for a clamping disc to the periphery of which the control knob 6 is clamped. The part 26 can be inserted into the blank during the operation of producing the blank (before  
25           the blank is bent into its final shape) and, similarly, if a formed constriction is provided this can be formed in the blank during the operation of producing the blank.

Secondly the blank has a central part 27 and a flange part 28. In forming the blank into its final shape the flange part 28 is bent through  $180^{\circ}$  relative to the central part 27. The characteristics of the line of weakness are selected so that the bending takes place in a predetermined manner and holes 29 in the flange part 28 become precisely aligned with holes 30 in the central part 27. The achievement of such precise alignment is not possible in more conventional bending techniques and in those cases the holes 29, 30 would have to be made after bending. In the particular embodiment described the holes 29, 30 are provided to provide a pivot for a colour filter element but it will be appreciated that the purpose of the holes is immaterial to the present invention.

The blank shown in Figure 5 has two side flanges 70 and a rear tab 71 which are all bent through a right angle and used to secure the formed blank to the rest of the floodlight casing.

Referring now to Figure 5A, the central part of the floodlight casing has an upper section 72, middle section 73 and lower section 74 which all belong to a common blank bent along lines of weakness L formed at the junctions of the sections. Screws 75 secure the rear tab 71 of the blank shown in Figure 5 to the middle section 73 and the side flanges 70 to the upper and lower sections 73, 74. In this way a rigid casing of considerable strength is produced.

It will be appreciated that the details of the

final form of the housing and casing are not matters with which the present invention is concerned. Mounting holes for other parts not mentioned may also be provided and/or the arrangement of the holes described above may  
5 be varied according to the particular requirements of the luminaire in question.

Figure 6 shows a spotlight 50 having a top baffle member 51 made from a blank. The spotlight 50 has side members 52 secured in fixed relationship to one another  
10 by fastening to the front and back plates 53 of the spotlight casing. The top baffle member 51 is located in grooves 54 in the side members 52.

Referring now also to Figures 7 and 8 the top baffle member has an upper part 55 the edges of which  
15 are received in the grooves 54, a lower part 56 with inclined wing portions 57 and an end part 58 which fits inside the back plate 53 of the spotlight. The upper part 55 has ventilating holes 59 which allow the passage of hot air from the lamp in the spotlight around the wing  
20 portions 57 and out of the luminaire. The wing portions prevent direct light from the lamp penetrating through the holes 59.

Figure 9 shows the blank from which the top baffle member is made. As in the previous embodiment lines of  
25 weakness L defined by a series of slots made up of substantially rectangular apertures 60 are formed in the blank.

The distal end of the lower part 56 has sloping

side sections 61 and in the centre a projection 62 which is engageable in a recess 63 in the end part 58.

To form the blank into the baffle member 51 the lower part 56 is first folded through  $180^{\circ}$  and the end part 58 is then bent through an angle of more than  $90^{\circ}$  to the position shown in Figure 7 so that the projection 62 enters the recess 63. This interlocking formation holds the top baffle member in an assembled condition. Finally the wing portions 57 are bent away from the upper part 55 until their sloping side sections 61 meet the end part 58 and, if necessary, during this step some adjustment of the bend of the end part 58 can be made.

Figure 10 shows the various punching operations carried out to form the blank of Figure 9. The boundaries of the blank are formed by punching narrow slots for example those referenced 64 in the sheet metal and in order to obtain the correct length of any particular slot, the slots overlap; for example the sides of the lower part 56 are formed by two slots 65 which overlap in a region 66. The sloping side sections 61 of the lower part 56 are formed by punching a series of small holes along these side sections. For the sake of simplicity Fig. 10 shows only the extreme blows of each series joined by the common tangent lines.

In a particular example of the invention using quarter hard aluminium as the material for the blank, the blank has a thickness of 1.2 mm and a line of weakness is made

up of a plurality of rectangular slots equispaced from one another by a distance (centre to centre) of 33.6 mm with a width perpendicular to the line of weakness of 2 mm and a length of 32 mm. With this example the blank can be bent  
5 about the line of weakness with great accuracy.

It will be seen that in the various embodiments of the invention described above the angle of bending about a line of weakness is defined by the interengagement of different parts of a blank or parts of different blanks. For example  
10 the lower part 56 is bent through  $180^{\circ}$  and that angle of bending is defined by the interengagement of the projection 62 in the recess 63; also, the wing portions 57 are bent away from the upper part 55 and the end part 58 bent until these two parts meet.



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Claims:

1. A method of making a luminaire in which at least one structural component of the luminaire is made by providing one or more sheet metal blanks, punching apertures in the one or more blanks to define lines of weakness therein, bending the one or more blanks along the lines of weakness and securing together different parts of a blank or parts of different blanks that, after bending, are next to one another to retain the blank or blanks in their correctly formed position.

2. A method as claimed in claim 1 in which the dimension of an aperture perpendicular to its associated line of weakness is between 80 per cent and 250 per cent of the thickness of the sheet metal blank.

3. A method as claimed in claim 1 or 2 in which the bending is carried out by hand.

4. A method as claimed in any preceding claim in which at least one of the lines of weakness is formed by a series of slots, the slots being separated by narrow bridging portions.

5. A method as claimed in any preceding claim in which the different parts of the blank or parts of different blanks are secured together by interlocking formations formed in the blank.

6. A method as claimed in any preceding claim in which there are features on different parts of a blank or parts of different blanks that, after bending the

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blank or blanks, are precisely positioned in a predetermined relationship with one another.

7. A method as claimed in any preceding claim in which the angle of bending about a line of weakness is defined by the interengagement of different parts of a blank or parts of different blanks.

8. A luminaire including at least one structural component which is made from one or more sheet metal blanks which has or have been bent along lines of weakness defined by apertures formed in the blank or blanks to form a three dimensional structural component, different parts of a blank or parts of different blanks being next to one another after bending and being secured together to retain the blank or blanks in their correctly formed position.

9. A luminaire as claimed in claim 8 in which at least one of the lines of weakness is formed by a plurality of apertures spaced along the line of weakness.

10. A luminaire as claimed in claim 9 in which the apertures are in the form of elongate openings.

11. A luminaire as claimed in claim 10 in which at least one of the lines of weakness is formed by a series of slots the slots being separated by narrow bridging portions.

12. A luminaire as claimed in any of claims 8 to 11 in which the dimension of an aperture perpendicular to

its associated line of weakness is between 80 per cent and 250 per cent of the thickness of the sheet metal blank.

13. A luminaire as claimed in any of claims 8 to 12 in which said different parts of the blank are secured together by interlocking formations formed in the blank.

14. A luminaire as claimed in any of claims 8 to 13 in which the structural component is a housing.

15. A luminaire as claimed in claim 14 in which the housing is made from a blank having a central part on opposite ends of which side parts are connected and along one side edge of which a base part is connected.

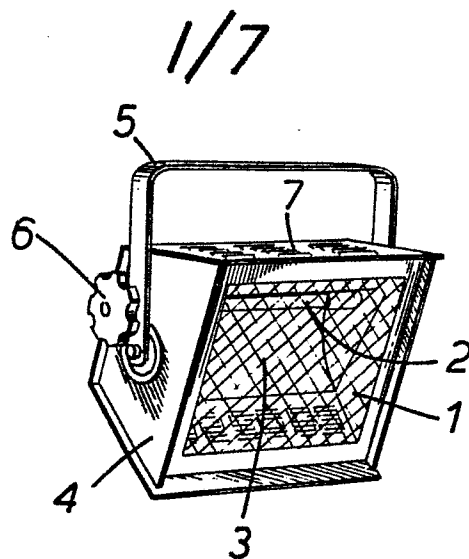


FIG. 1.

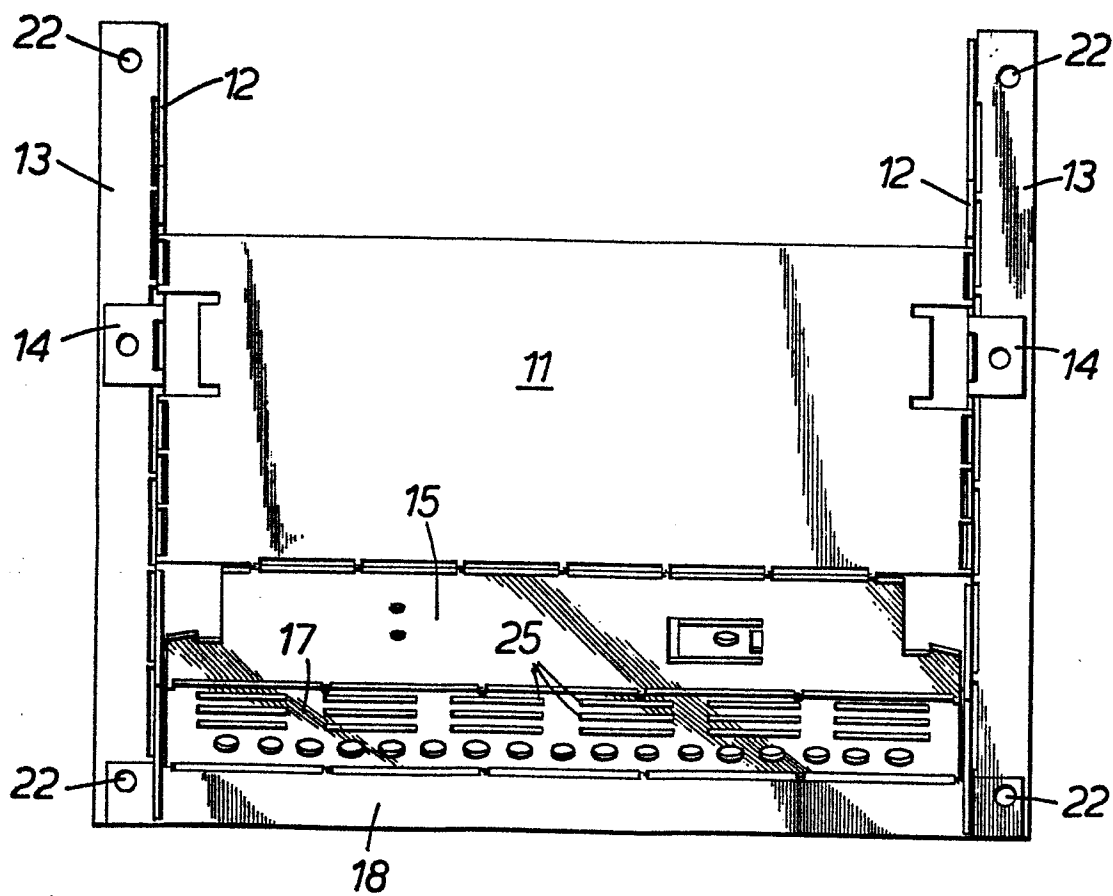


FIG. 3.

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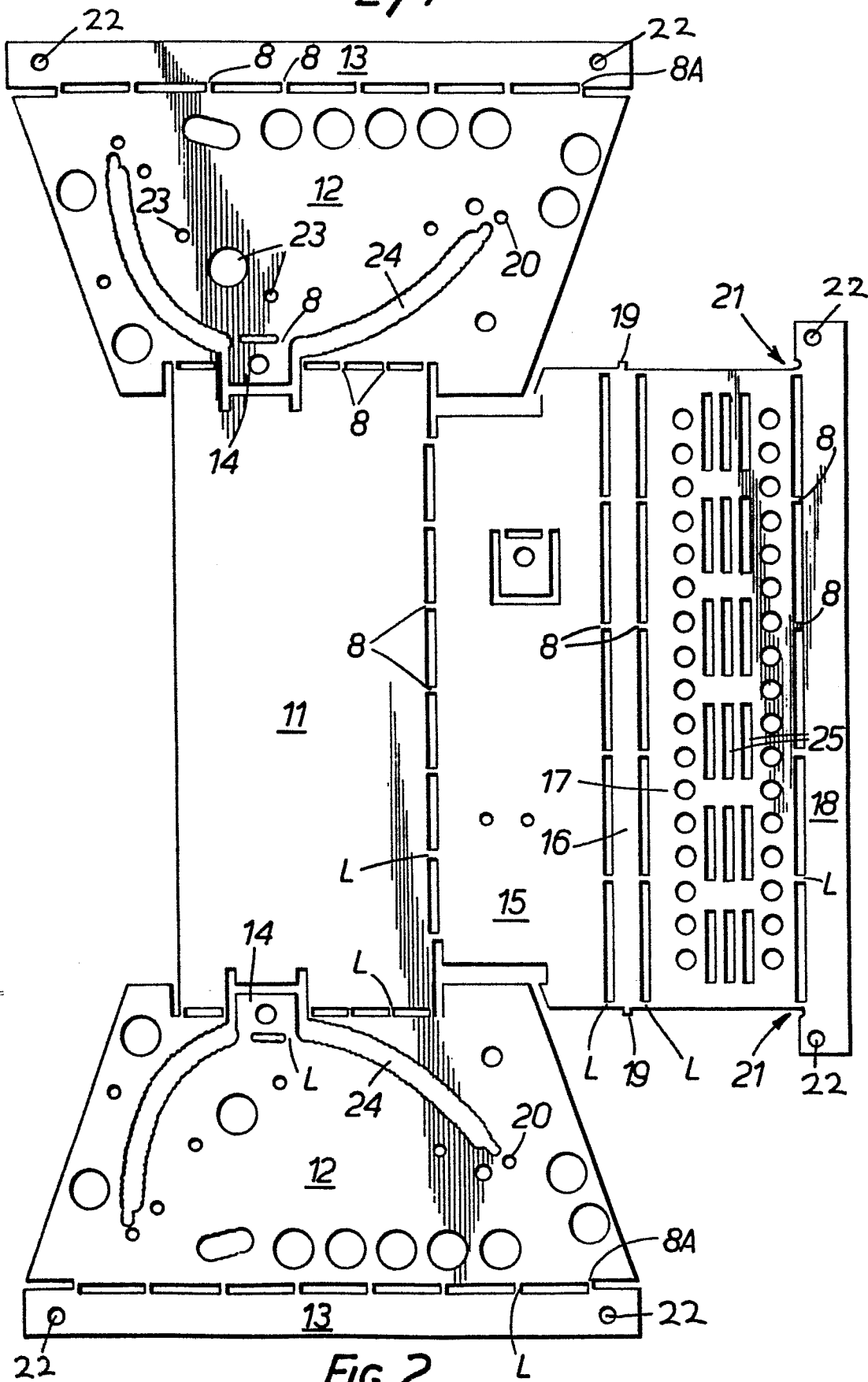
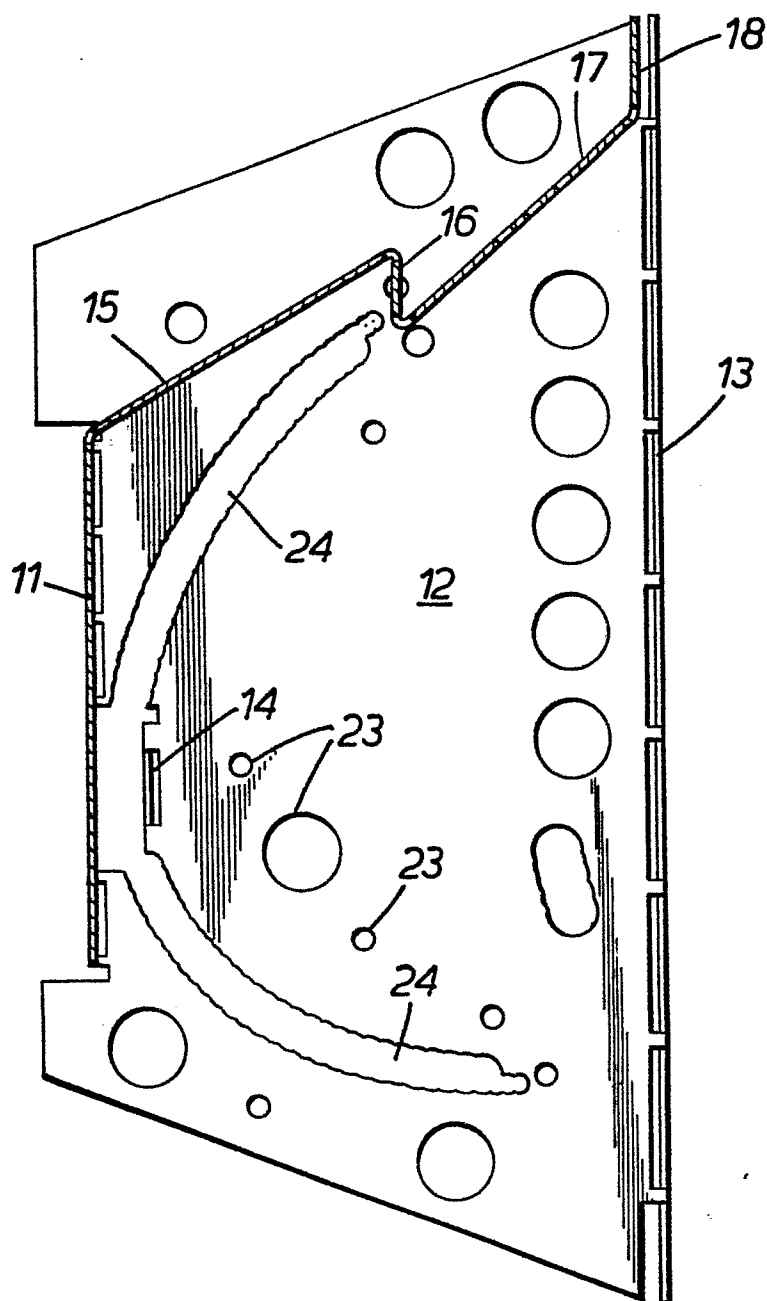


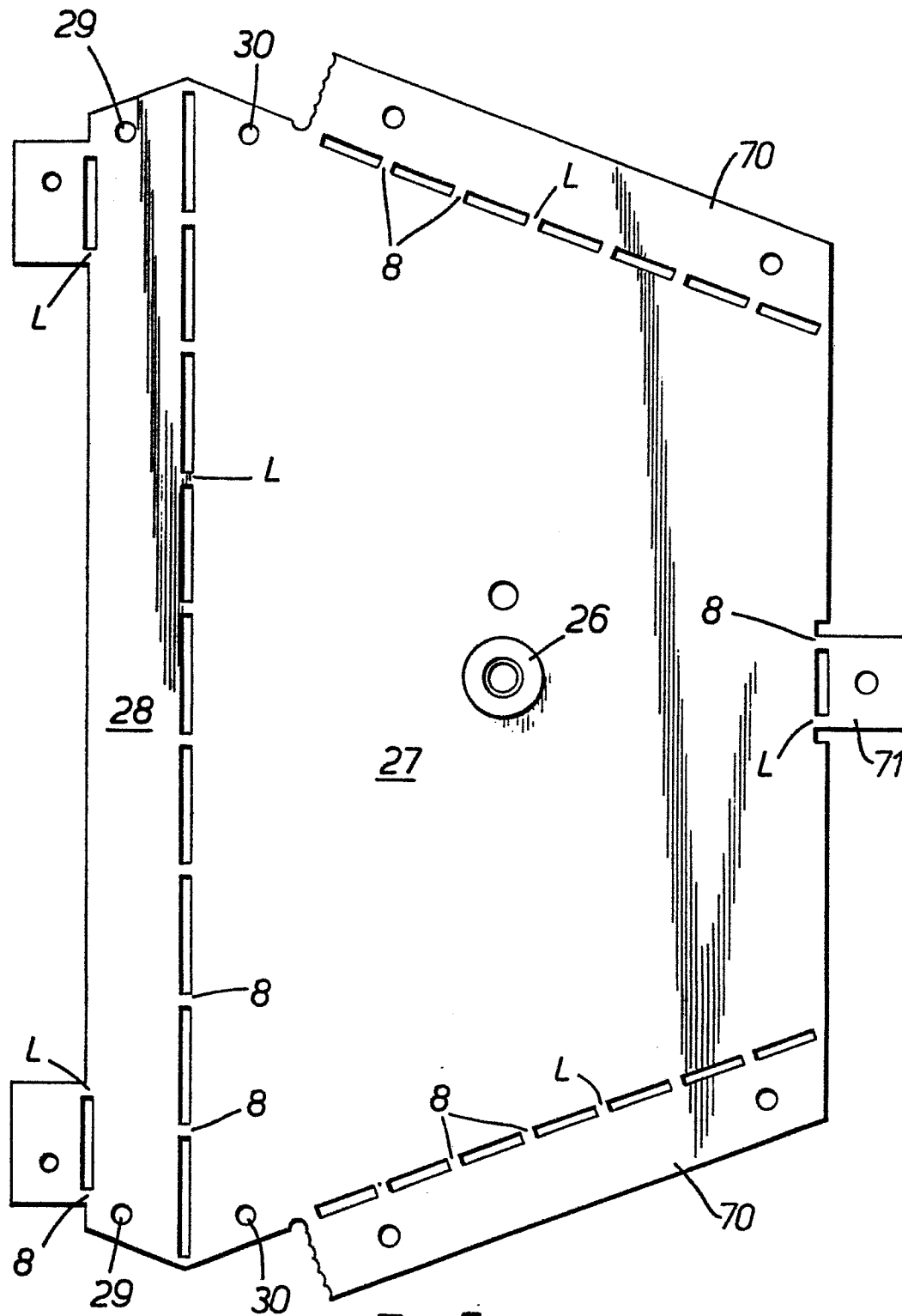
FIG. 2.

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**FIG. 4.**

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**FIG. 5.**

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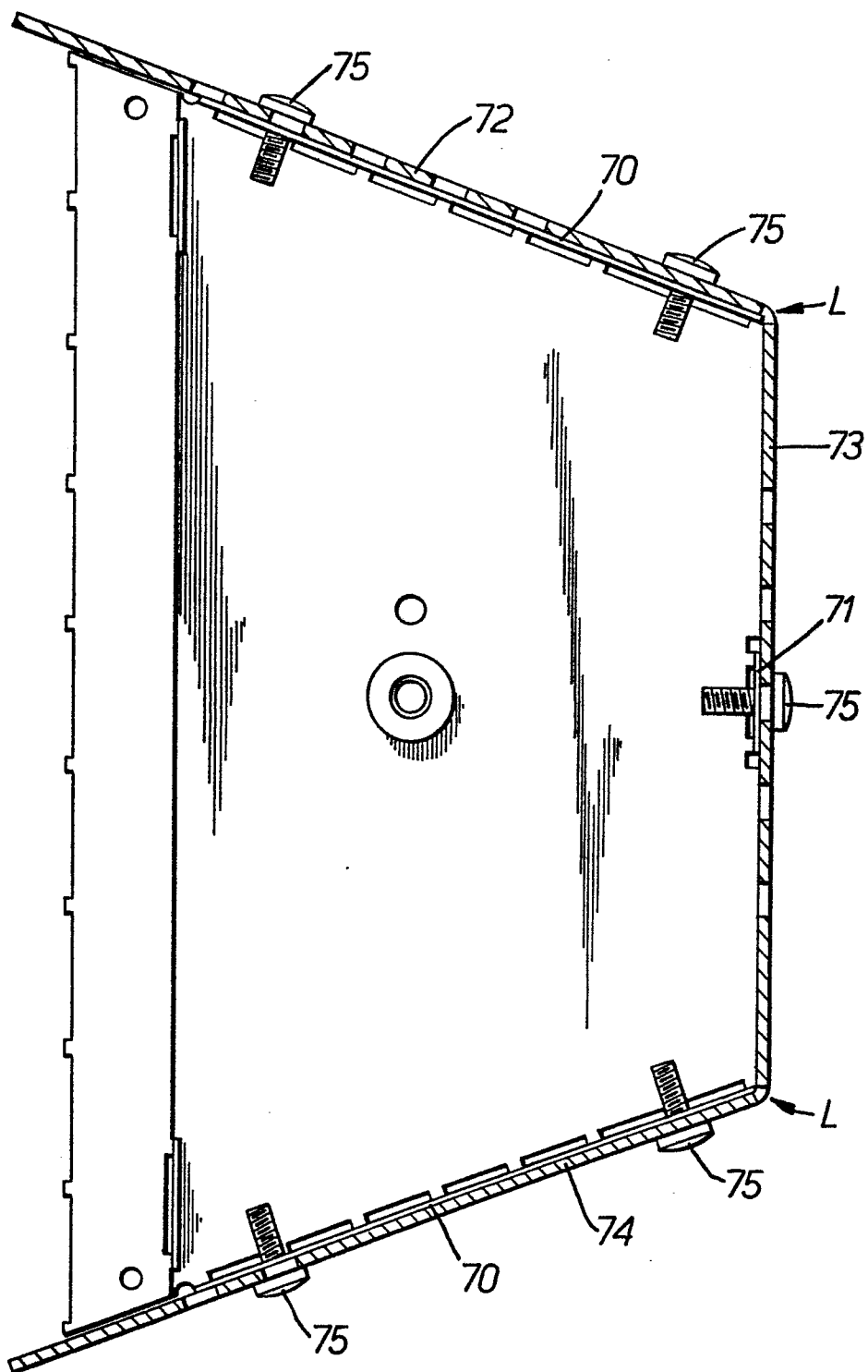


FIG. 5A.



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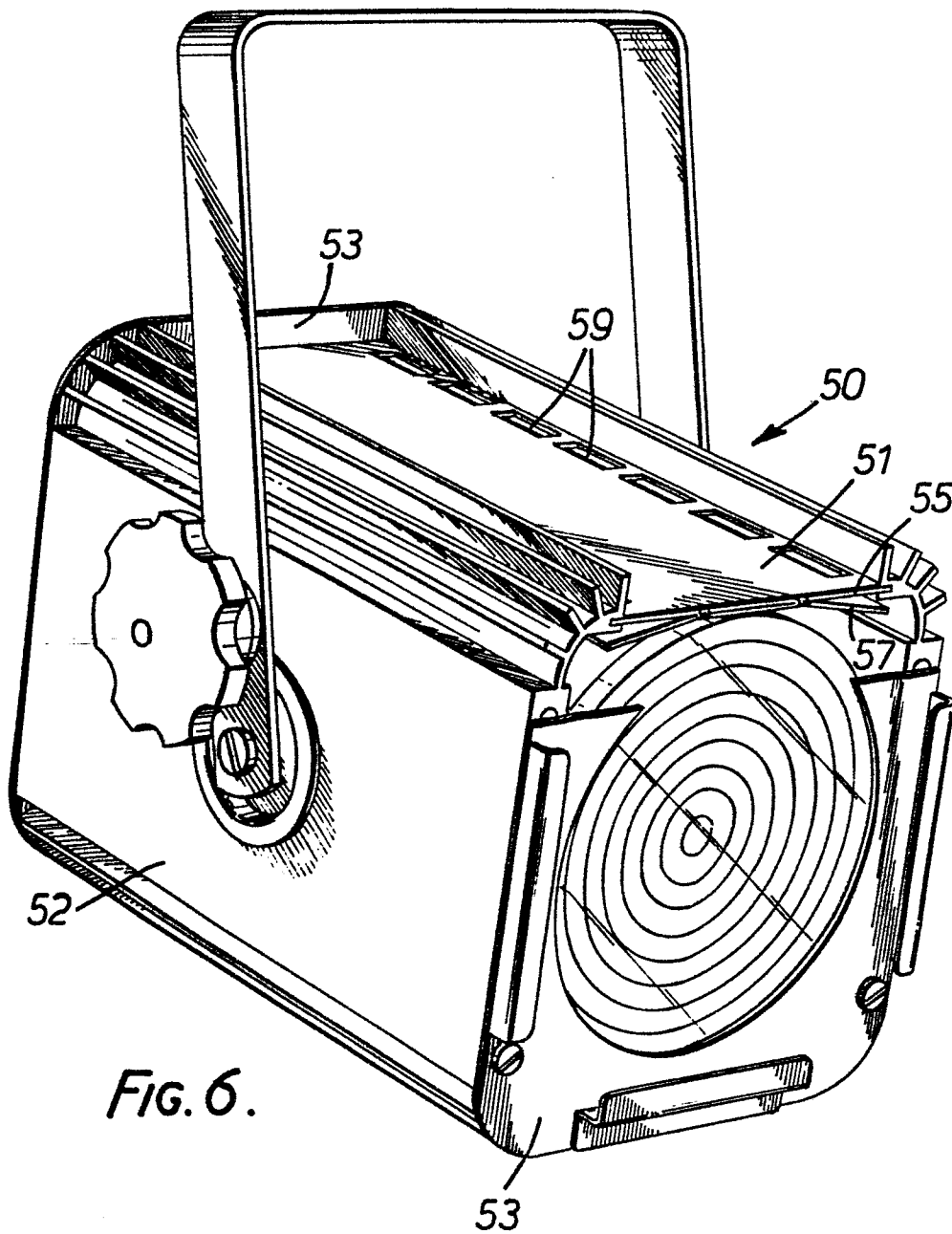


Fig. 6.

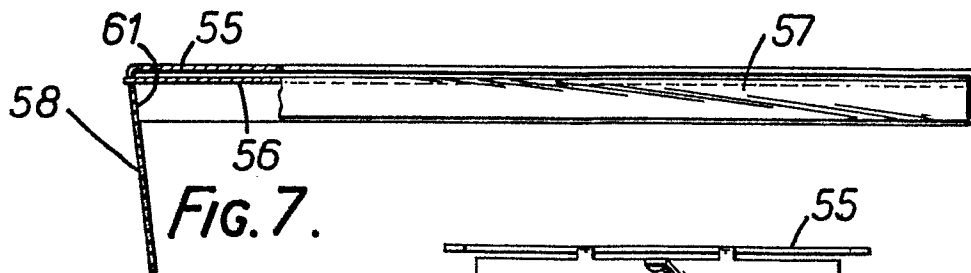


Fig. 7.

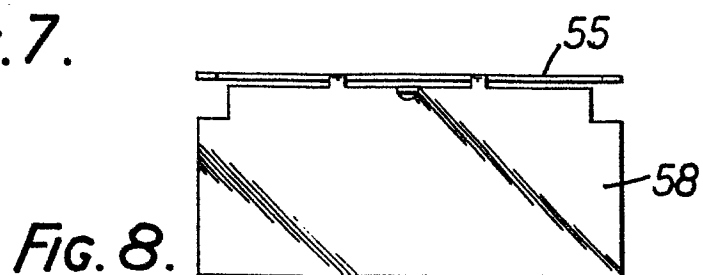
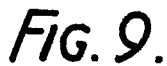


Fig. 8.





European Patent  
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# EUROPEAN SEARCH REPORT

**0071476**

Application number

EP 82 30 4007

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Y	--- GB-A-1 585 433 (BOHNACKER)  *The whole document*	1,2,3, 4,8,9, 10,11, 12	F 21 S 1/00
Y	--- DE-A-2 233 471 (LICENTIA PATENT)  *The whole document*	1,5,6, 7,8,13 ,14	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			F 21 S F 21 P B 21 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 04-11-1982	Examiner FOUCRAY R.B.F.
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