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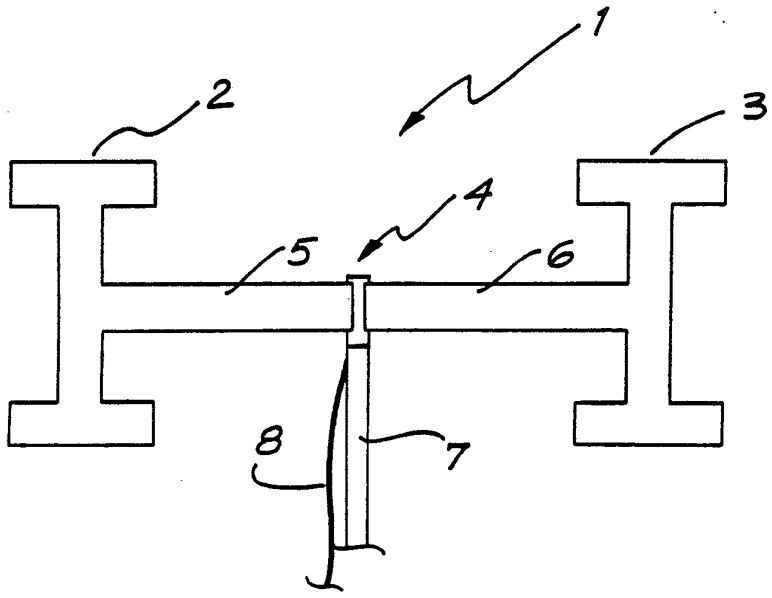
(54) Title: BROAD FREQUENCY RANGE AERIAL



(57) Abstract

A device for receiving and/or transmitting electromagnetic signals in the form of waves from or in a broad frequency range from 33 MHz to 1042 MHz. The device comprises a planar element (1) having an array of constituent planar plates (2, 3, 5, 6) arranged in a configuration such that the planar element (1) is symmetrical about at least one axis with each of the said plate members being connected either indirectly or directly to, or continuous with, the other plate members. The planar plates provide an enlarged capture and transmission area for electromagnetic waves on the front and rear faces of said plates.

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Broad Frequency Range Aerial

The present invention relates to an improved device for receiving or transmitting, but in particular, for receiving radio waves in the form of electromagnetic signals emanating from a transmitter such as radio, television or radio. In particular the invention has the ability to pick up electromagnetic waves from a broad frequency range and it also has the facility to transmit electromagnetic signals.

There are numerous aerials commonly known as antennas which are designed in various configurations for receiving signals from sources of transmission. The configuration of the antennas is usually critical to their ability to effectively receive the signals which they have been designed to receive. Also, the direction in which the various components of the antennas face relative to the direction of the source of the electromagnetic signal to be received and relative to other components of the aerial is important to the effective operation of the particular aerial.

The basic function of a receiving antenna is to interrupt the radio or other electromagnetic waves transmitted from a transmitting antenna.

The radio waves are transferred from their source through an air medium.

The simplest form of known receiving antenna is a dipole antenna usually for receiving television signals. This consists of at least two quarter wave rods attached to an insulation block which is also attached to a transmission line. This type of antenna is configured so that the said rods are parallel to the earth and generally face the direction from which the television signal is coming.

This type of antenna is seldom used but serves as a basic illustration of how the configuration of an aerial is critical to its effective performance. In addition to the overall configuration, the length of the said rods

preferably correspond to segments of the overall physical length of the radiated wave.

The attitude of the rods relative to the direction of the waves being received determine which wave is best received. For instance, this antenna is least receptive to waves which emanate from the direction in which the ends of the rods of the antenna are pointed. Waves coming perpendicularly to the rods are received best, however, the shortcomming exists that wave interference can occur.

A more commonly known and used form of prior art aerial is the single or dual folded dipole antennas for multi directional reception. This aerial is more commonly used for FM band high and ultra high frequency radio wave reception. It is not recommended for use in television reception as it would pick up reflected signals in addition to the desired signal. This would lead to confusion of signals and in the case of television receivers, ghosting of the image. If a reflector rod is introduced behind the folded dipole portions of a dipole antenna the reflector picks up signals which are reflected back toward the antenna thereby increasing the sensitivity of the antenna. The reflector also reduces reception from behind the antennas. The folded dipole antenna is capable of picking up low band VHF television channels or the high band VHF channels.

The sensitivity of these antennas can be improved by stacking two folded dipole antennas one on top of the other. One of these could conceivably be a high band antenna with the other being a low band antenna. This type of aerial configuration which is known as a yagi configuration allows low band reception from one direction and high band reception from another direction. The yagi configuration can be set in numerous different ways so that response to directional changes can be achieved.

A further type of prior art antenna is the UHF antenna. VHF waves are far shorter than UHF waves so

that antennas designed to receive UHF waves are comprised of short elements thereby making the antennas considerably smaller than VHF antennas. In this antenna there is a dipole element consisting of two plates which are disposed in front of a reflector grid. This type of aerial is highly directional with the rearward rejection of signals being highly effective. As with VHF antennae these VHF antennae can be stacked to improve reception. Other configurations of UHF aerials are known each using dipoles and a reflector. An increase in the number of elements in the reflector of these aerials makes them highly sensitive and direction dependant, and the elimination of mutually exclusive elements to form the receptor device of the present invention results in the device being less direction dependant.

It is possible to combine FM band UHF and VHF frequency bands in the one aerial.

Many other aerial types are known such as single channel antennas and all channel antennas, all of which are highly dependant for their sensitivity on the lengths and spacings of the various elements in order to achieve the requisite directivity and sensitivity.

Although there are literally hundreds of prior art aerials having varying reception and transmitting abilities and characteristics there has not previously been known a device having a broad element surface area presented to the direction of transmitted waves.

Also, it has not hitherto previously been known to provide a broad surface area electromagnetic wave receiving and/or transmitting device having the ability to receive electromagnetic signals from a broad frequency range of 33 MH_z to 1042 MH_z wherein the aerial comprises a driven element with or without reflectors, unlike the previously described prior art aerials.

The prior art aerials have numberous attendant disadvantages not possessed by the present invention. In particular they are direction sensitive, they suffer from the effects of the noise phenomenon and they suffer from rebound and ground effects.

The present invention overcomes these disadvantages and behaves in a manner not previously achieved in electromagnetic wave receiving or transmitting devices. The device can be constructed by configuring an array of metal plates to form what can be regarded as a single element according to configuration formulae. Alternatively, the same configuration can be pressed or cut from sheet aluminium. The single element is comprised a series of attached planar plate members which receive signals on the large capture area provided by the plates. The capture area is very large relative to the capture areas of conventional electromagnetic signals receiving and transmitting devices. No capture of signal takes place on the edge of the plate under normal operational conditions.

A further advantage of the present invention resides in the fact that the noise factor which has a deleterious effect on signal reception in conventional electromagnetic signal receptors is significantly reduced with a consequent improvement in reception and clearer image and/or sound reproduction.

A further difference which exists over the prior art is that it does not have what is known in the art as signal gain as traditionally known due to the fact that the signal is magnified by the large capture area and due to the low noise factor.

The conventional electromagnetic wave receptors comprise a ratio approximately within the range of a 68% - 71% signal to 29% - 32% noise. The present invention comprises a ratio approximately within the range of 91% - 94% signal to 6% - 9% noise.

Generally, prior art aerials and receptors have certain height requirements which necessitate specific ground clearance for best reception.

The present invention on the other hand is not ground distance dependant due primarily to the large capture area and its ability to use surrounding surfaces as reflective screens.

The behaviour of the present invention in relation

to its attitude relative to the ground differs from the conventional yagi type antennas. The latter operate optimally with a slightly upward tilt and the former operates optimally in some locations with a downward tilt.

The device of the present invention receives electromagnetic radio waves but in a quite different manner from that of the prior art aerials. It has been found by testing that the received signals run along the edge of the flat plates which form the receiving device. Furthermore, this device is neither direction nor attitude sensitive, however, it does have the capacity and facility to benefit in some locations from special attention paid to direction and attitude and position relative to structures and geographic phenomena.

The device, due to the flat plate technology employed receives selectively all of the ultra high frequency and very high frequency radio and television waves. Preferably the receiving device is fabricated from specially tempered aluminium with a thickness within the range 2mm to 3mm and due to the configuration and relative sizes and angles of disposition of the plates the device is capable of vertical and horozontal polorisation.

The effective reception of the electromagnetic radiation is largely dependant upon the configurational symmetry of the device.

In its broadest form the present invention comprises a broad frequency range electromagnetic signal receptor comprising an array of planar members configured in such a way as to form two spaced apart substantially I shaped members joined to each other at their mid section by a transverse plate, said transverse plate being joined to a support member and a transmitting line leading to a signal receiving apparatus.

In another broad form the invention comprises a device for receiving and/or transmitting electromagnetic signals in the form of waves from or within a broad frequency range.

In another broad form the invention comprises a device for receiving and/or transmitting electromagnetic signals in the form of waves from or within a broad frequency range,
said device comprising:
a symmetrical planar element comprising at least one planar plate having an electromagnetic wave capture area.

In a further form the invention comprises a device for receiving and/or transmitting electromagnetic signals in the form of waves from or in a broad frequency range, said device comprising a planar element having an array of constituent planar plates arranged in a configuration such that the planar element is symmetrical about at least one axis with each of said constituent plate members being connected either indirectly or directly to or continuous with the other plate members, said plate members providing an electromagnetic wave capture area for transmission of said electromagnetic signals to a receiving appliance.

In the preferred embodiment the aerial is adapted to receive any signal within the frequency range 33 MH_z to 1042 MH_z.

One significant feature of the present invention is the enlarged signal capture area provided by the plates.

The present invention will now be described in more detail according to a preferred but non limiting embodiment and with reference to the accompanying illustrations wherein:

Figure 1: depicts a front elevational view of the aerial according to a preferred embodiment of the invention.

Figure 2: depicts an isometric view of the aerial of figure 1.

Figures 3 to 10: show plan views of various configurations of the device according to alternative embodiments of the present invention.

Referring to figure 1 there is shown a front elevational view of the broad range frequency receptor device 1.

The receptor device 1 is shown according to the preferred embodiment and comprises a first I shaped element 2 a second I shaped element 3 spaced apart from said first I shaped portion 2 each of said I shaped portions being interlinked and spaced apart by an elongated plate element 4 which can be comprised of conjuncted members 5 and 6.

Attached to the spacer element is a supporting stand 7 upon which one end of each of members 5 and 6 are mounted in order to provide structure support for the total receptor. A transmitting line 8 runs from spacer element 4 according to conventional means thereby providing the requisite link between the receptor and the receiving appliance.

It has been found in field tests that the depicted configuration of the receptor as shown provides a high signal sensitivity and directivity when the front view is placed facing the direction from which the transmitted signal to be received is emanating.

The receptor is able to receive signals on the large capture area from the front and rear directions along a broad frequency range.

Figure 2 shows the receptor of figure 1 in an isometric view. From this figure it can be seen that the I portions 2 and 3 are comprised of interconnected flat plates of a thickness of approximately 3mm. Each plate is disposed at right angles to its adjacent plate. Tests have shown that the configuration of each plate at right angles is important to the receptor sensitivity.

As with conventional aerials the beam width or directional characteristics are important. The operational beam width falls between 0^{o} - 11^{o} and 11^{o} - 60^{o} for a variety of frequencies within the overall frequency range for reception of the receptor. For other frequencies within the range 33 MH_z to 1042 MH_z beam width is more narrow leading to reflection of

signals coming from unwanted directions.

It is conceivable that due to the broad frequency capability of the receptor device, a variety of receiving apparatuses can effectively and clearly receive signals at the same time from the same receptor.

The receptor is installed on a conventional mounting means with attention being paid to directivity for best results.

In an alternative embodiment (not shown) the receptor is constructed with conglomerations of plates running in various directions but maintaining the large signal capture area.

In addition slots can be cut in the plates to change the effectiveness of pick up of a particular radio frequency band.

The receptor traps the broad signal ranges due to a predetermined formula which sets the receptor device configuration.

In the preferred embodiment of the receptor distances a b, c, d, e, and f are considered critical to its operation.

Various other configurations of the invention are shown in accompanying figures 3 to 13. Each of the configurations shown have the common characteristics of the presentation of a relatively large surface area to the direction of incoming signals.

The following parameters arrociated with each embodiment of the device shown are critical to the performance of the device: metal type, thickness of the plates, the length and breadth of each plate the symmetry of the element and the configuration of the element whereby the constituent plates are all at 90^{o} relative to an adjacent plate.

Aluminium is the preferred metal however, the device can be fabricated from copper but with a result that the deivce can be 19% smaller and with the same performance charactertics for the particular configuration chosen. Where steel is used the device is necessarily 26% larger to achieve similar performance characteristics.

The insertion of slots or holes in any one or more of the constituent plates improves reception from a particular frequency.

In conventional antennas the signals are generally received or transmitted at the tips. According to the present invention the signals are transferred along the edges after being received on the face of the plates.

Not all of the edges of the device are necessarily used at any one time. For instance one frequency will use all of the edges several times and another frequency will use certain edges several times.

It will be recognised by persons skilled in the art that numerous variations and modifications can be made to the invention as broadly described herein without departing from the overall spirit and scope of the invention.

THE CLAIMS:

1. A device for receiving and/or transmitting electromagnetic signals in the form of waves from or within a broad frequency range,
said device comprising:
a symmetrical planar element comprising at least one planar plate having an electromagnetic wave capture area.

2. A device for receiving and/or transmitting electromagnetic signals in the form of waves from or in a broad frequency range, said device comprising a planar element having an array of constituent planar plates arranged in a configuration such that the planar element is symmetrical about at least one axis with each of said constituent plate members being connected either indirectly or directly to or continuous with the other plate members, said plate members providing an electromagnetic wave capture area for transmission of said electromagnetic signals to a receiving appliance.

3. A device according to claim 2 wherein each of the said plate members are disposed either parallel to or at right angles to one or more of the other plate members forming the array of plate members.

4. A device according to either one of claims 1, 2 or 3 wherein the axis or axes of symmetry generally intersect at the midpoint between the extremities of the planar element at which midpoint there is provided an element anchorage means and a coaxial cable termination.

5. A device according to claim 4 wherein the said at least one plate has the electromagnetic signal capture area on the front and or back of said plate or plates.

6. A device according to claim 5 wherein the said planar element is configured so as to comprise a longitudinal first planar plate terminating at each of its ends in a transverse plate array, each of said transverse plate arrays substantially forming an 'I' shaped plate portion.

7. A device according to claim 6 wherein the said first planar plate is divided into two symmetrical halves at its midpoint each of said halves being adapted with

means or allowing mating with means for effecting interconnection of the said two halves.

8. A device according to claim 7 wherein the ratio of the length of the first planar plate to the length of the said I shaped plate portions falls within the range 2:1 to 3:1.

9. A device according to claim 8 wherein the width of the said first planar plate is the same or substantially the same as the width of the plates forming said I shaped portions.

10. A device according to claim 9 wherein there is means provided at the said midpoint of said planar plate and on the said interconnection of said mating means to allow connection of a coaxial cable thereto for transmission of signals between said device and a transmitting or receiving appliance.

11. A device according to claim 10 wherein the electromagnetic signals received or transmitted fall within the range 33 MHz to 1042 MHz.

12. A device according to claim 11 wherein the signal input impedance averages 72 Ohm.

13. A device according to claim 12 wherein the bandwidth is 1009 MHz.

14. A device according to claim 13 wherein the said I portions have a length within the range 450 mm to 550 mm and the said planar plate has a length within the range 1000 mm to 1300 mm.

15. A device according to claim 14 wherein the thickness of the said first planar plate and said I shaped plate portions fall within the range 1 mm to 4 mm.

16. A device according to claim 15 wherein the said first planar plate and I shaped plate portions are made from aluminium.

17. A device according to claim 16 wherein the said two symmetrical halves are formed from a continuous solid cut out from a sheet of aluminium.

18. A device according to claim 11 wherein the first the first planar plate in both of said halves of said planar element has extending at ninety degrees therefrom

opposed T plates are located near or at a short distance from the said midpoint.

19. A device according to claim 18 wherein the elongated portions of each of said I shaped portions have extending outwardly therefrom at or near the midpoint of said elongated portion at least one T shaped plate.

20. A device according to claim 19 wherein the transverse member of each of the said T plates is narrower in width than the stem portion of said T plate.

21. A device according to claim 20 further comprising at least one T piece extending inwardly towards said midpoint of said element from at least one edge of each of the transverse legs of the I plate portions.

22. A device according to claim 21 wherein there is an additional T piece extending from the said transverse legs in a direction away from the midpoint of said element each of said T pieces further comprising plates extending from their transverse portions so as to substantially form a U.

23. A device according to claim 21 further comprising at least one T piece extending outwardly from the transverse portions of each of said I shaped portions in a direction normal to the longitudinal axis of the element.

24. A device according to claim 17 wherein each of the transverse portions of said I shaped members have extending therefrom at least one T portion in a direction parallel with the longitudinal axis of said element and/or perpendicular to the longitudinal axis of said element.

25. A device according to claim 24 wherein the stem of said I portion has extending therefrom in alignment with the longitudinal axis of said element a substantially U shaped member or an upturned U shaped member.

26. A device according to any one of the foregoing claims wherein the said electromagnetic signals are transmitted and/or received from the back front and sides of said plates then transmitted along the edges of said plates.

27. A device according to claim 16 wherein an operational relationship exists between the frequency received or transmitted and the portion of the edge of said device used for reception of and transmission of said signals such that electromagnetic waves of a particular frequency are selectively transmitted and or received from a particular section of said edges.

28. A device according to any of the forgoing claims wherein any one or more of said plates are adapted with slots.

29. A device according to claim 28 wherein the signals received by the device are received on the surface of the constituent plates then transmitted via the edges of said device to a coaxial cable linking said device to an appliance.

30. A device as hereinbefore described and with reference to the accompanying illustrations.

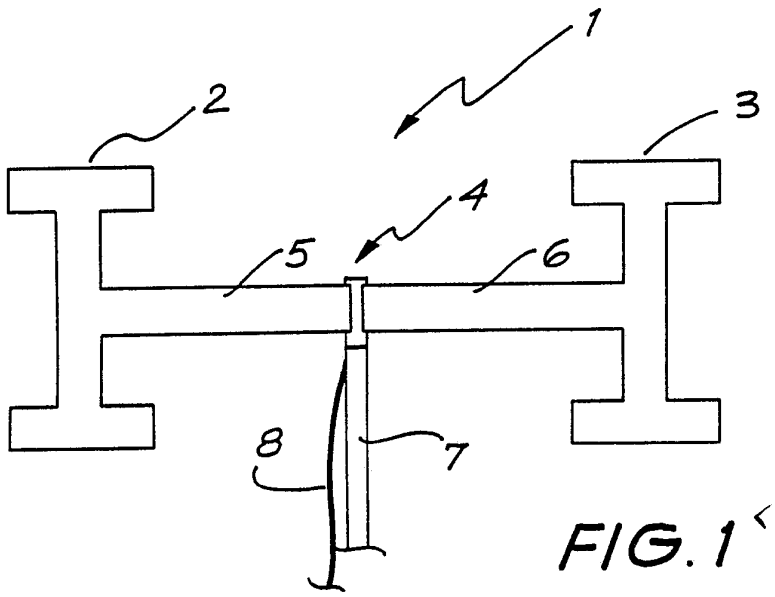

FIG. 1

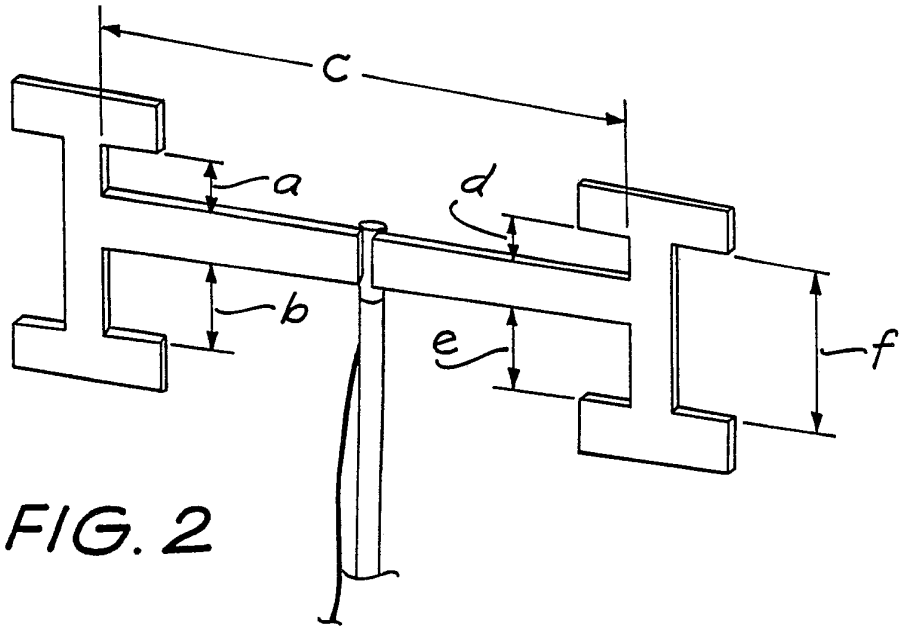

FIG. 2

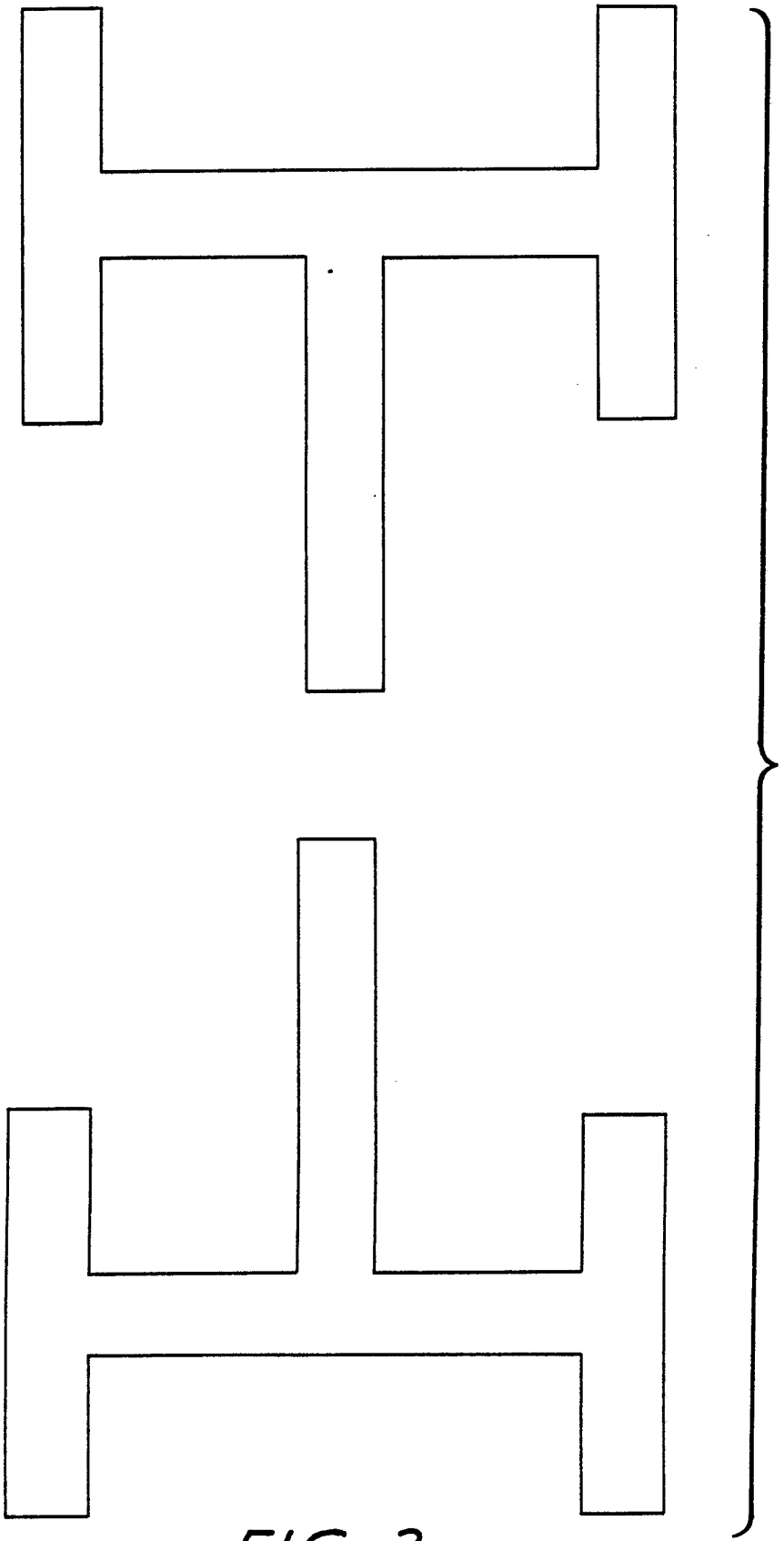

FIG. 3

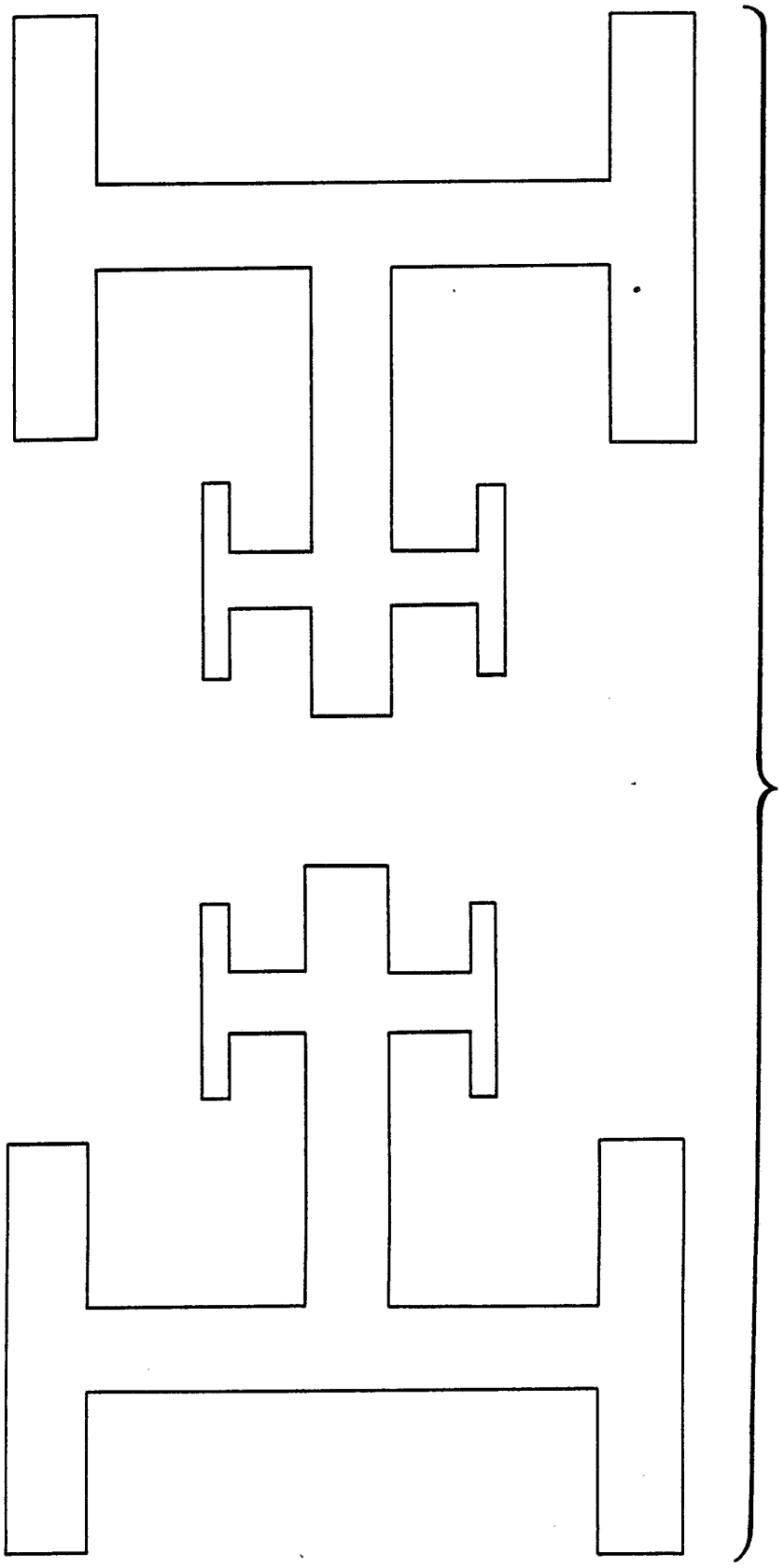

FIG. 4

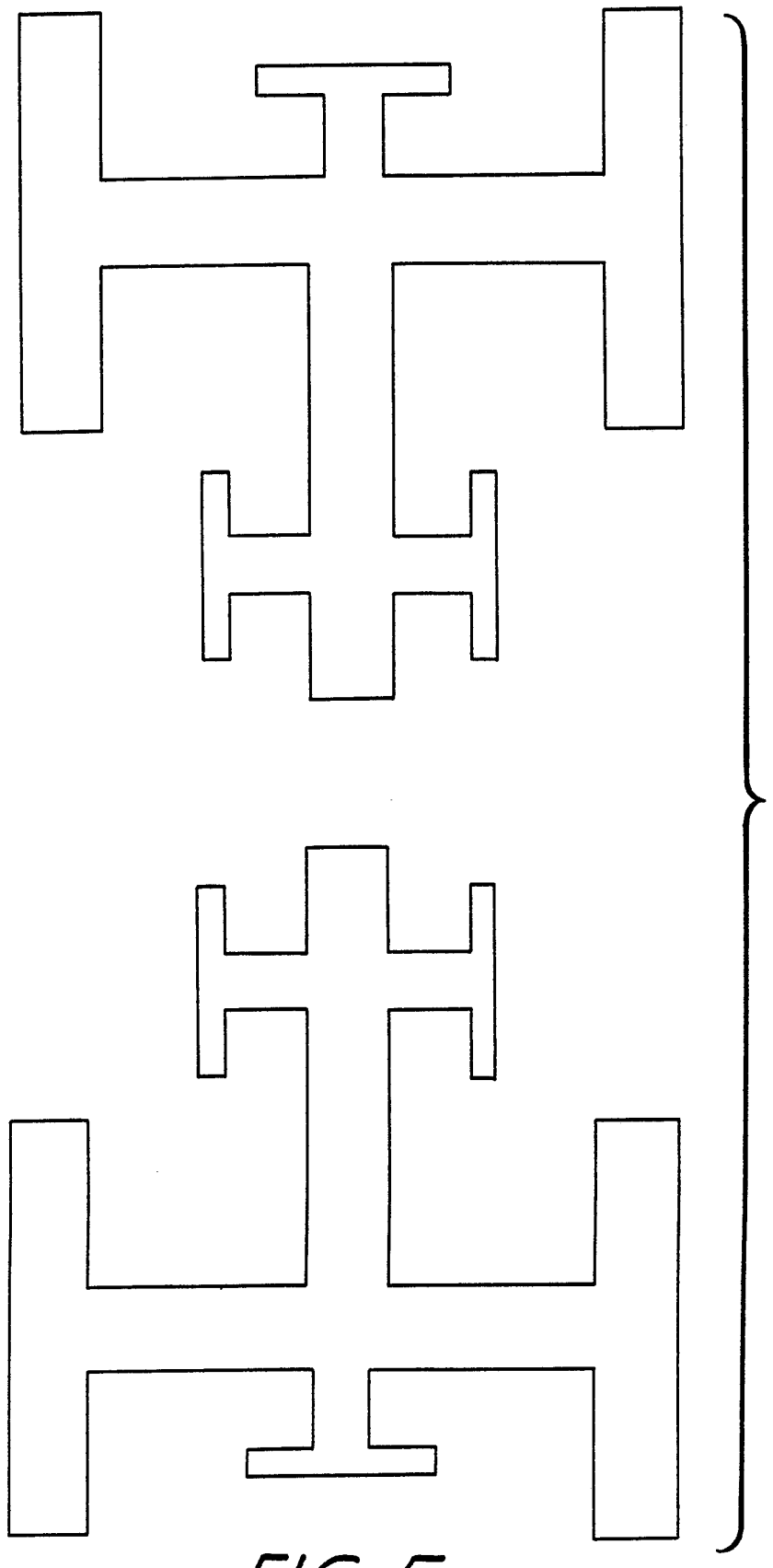

FIG. 5

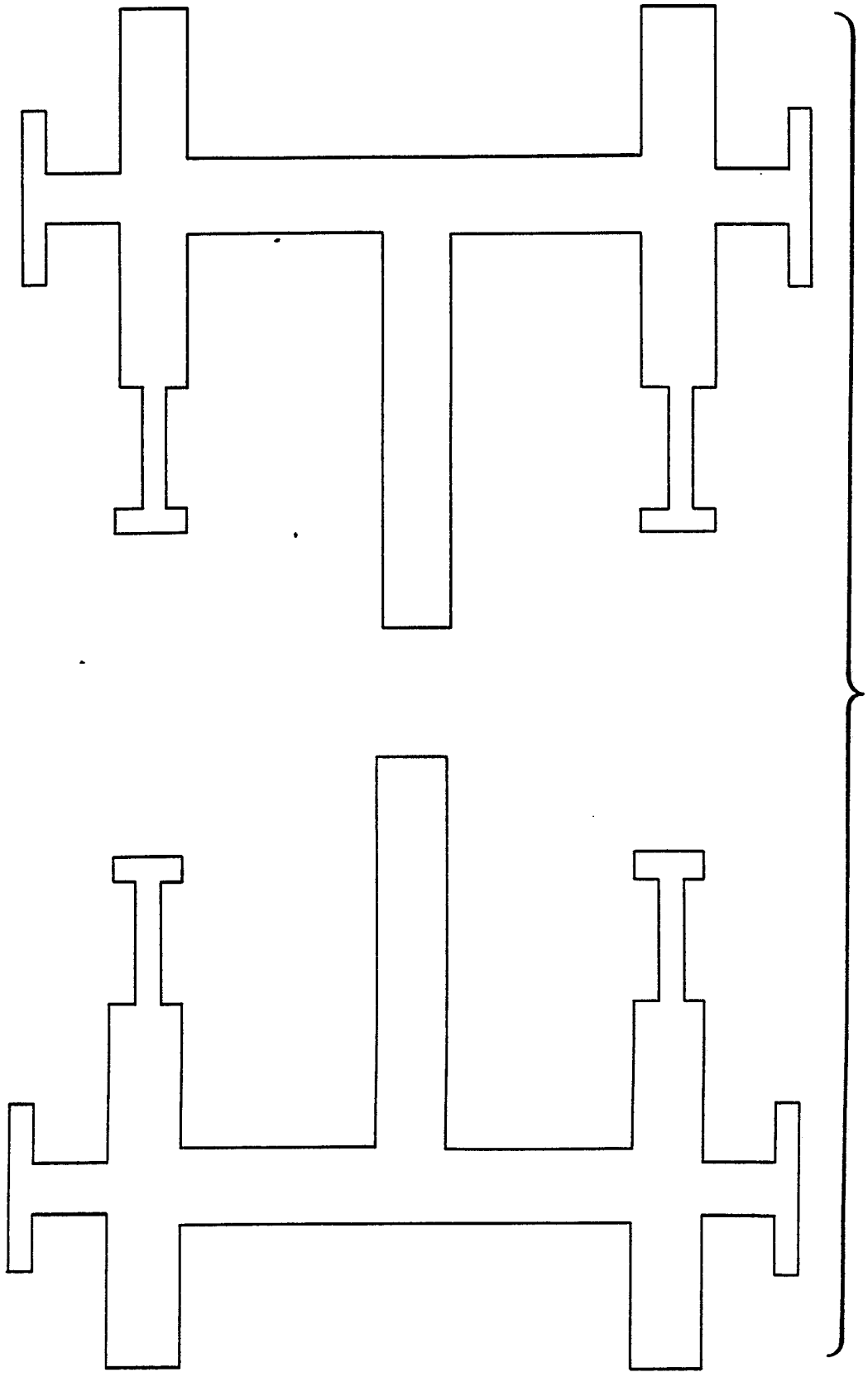

FIG. 6

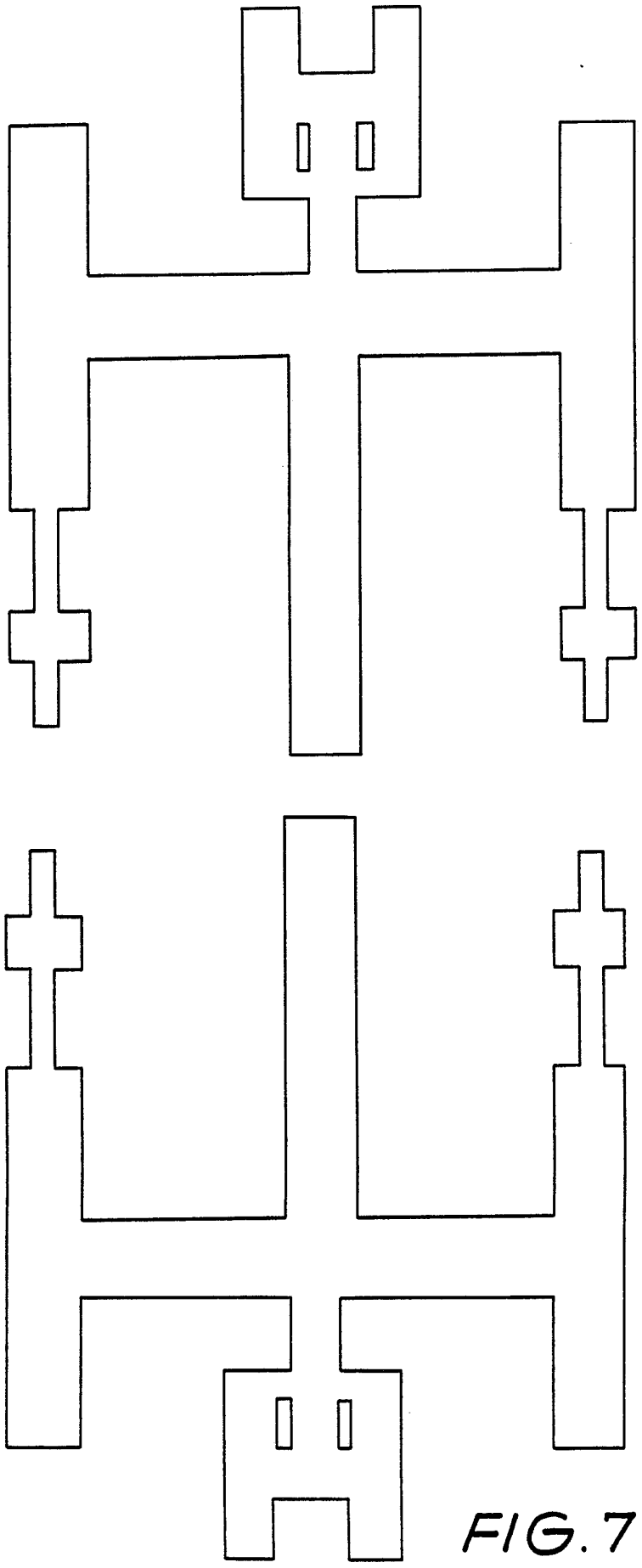

FIG. 7

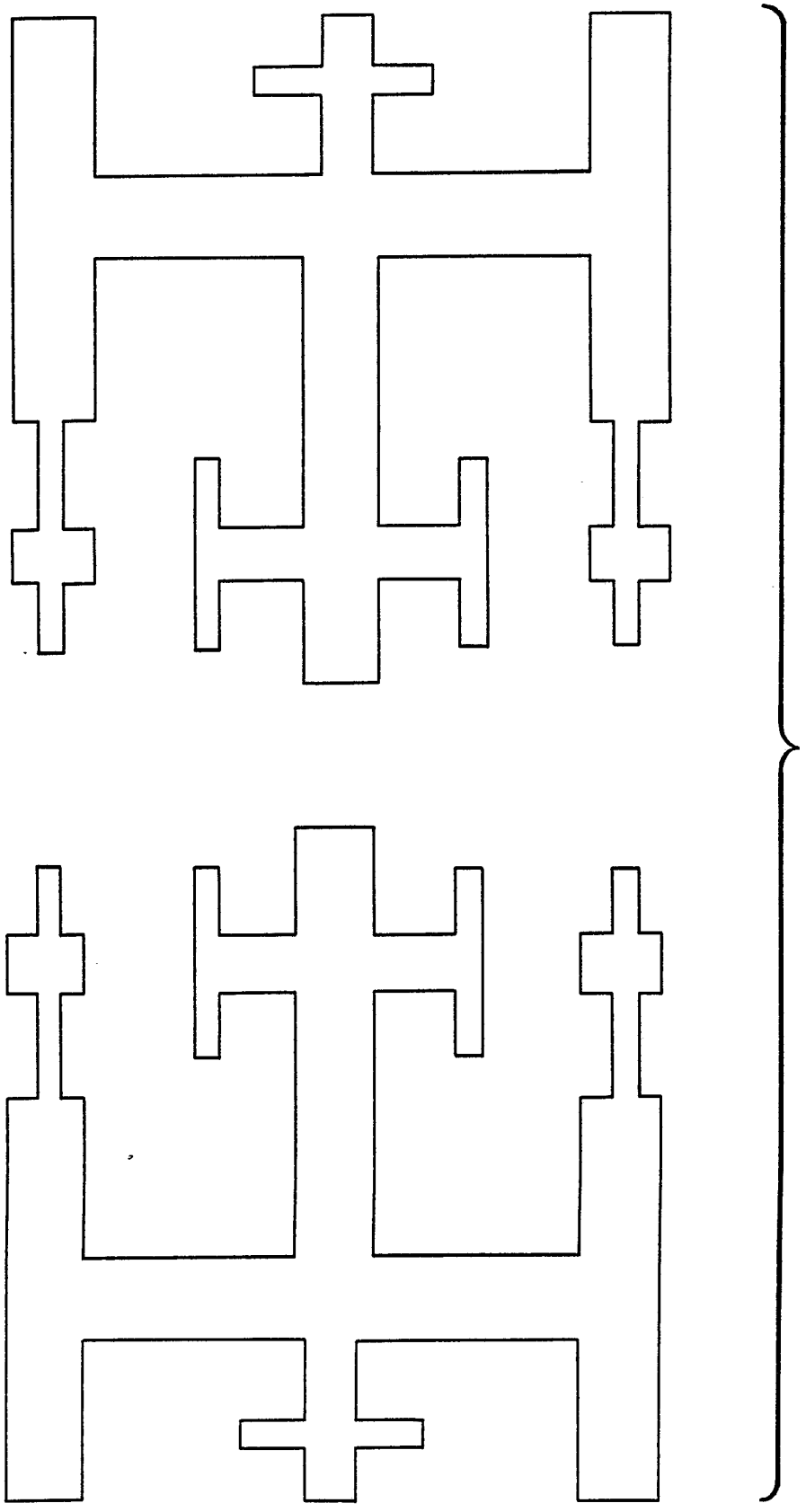

FIG. 8

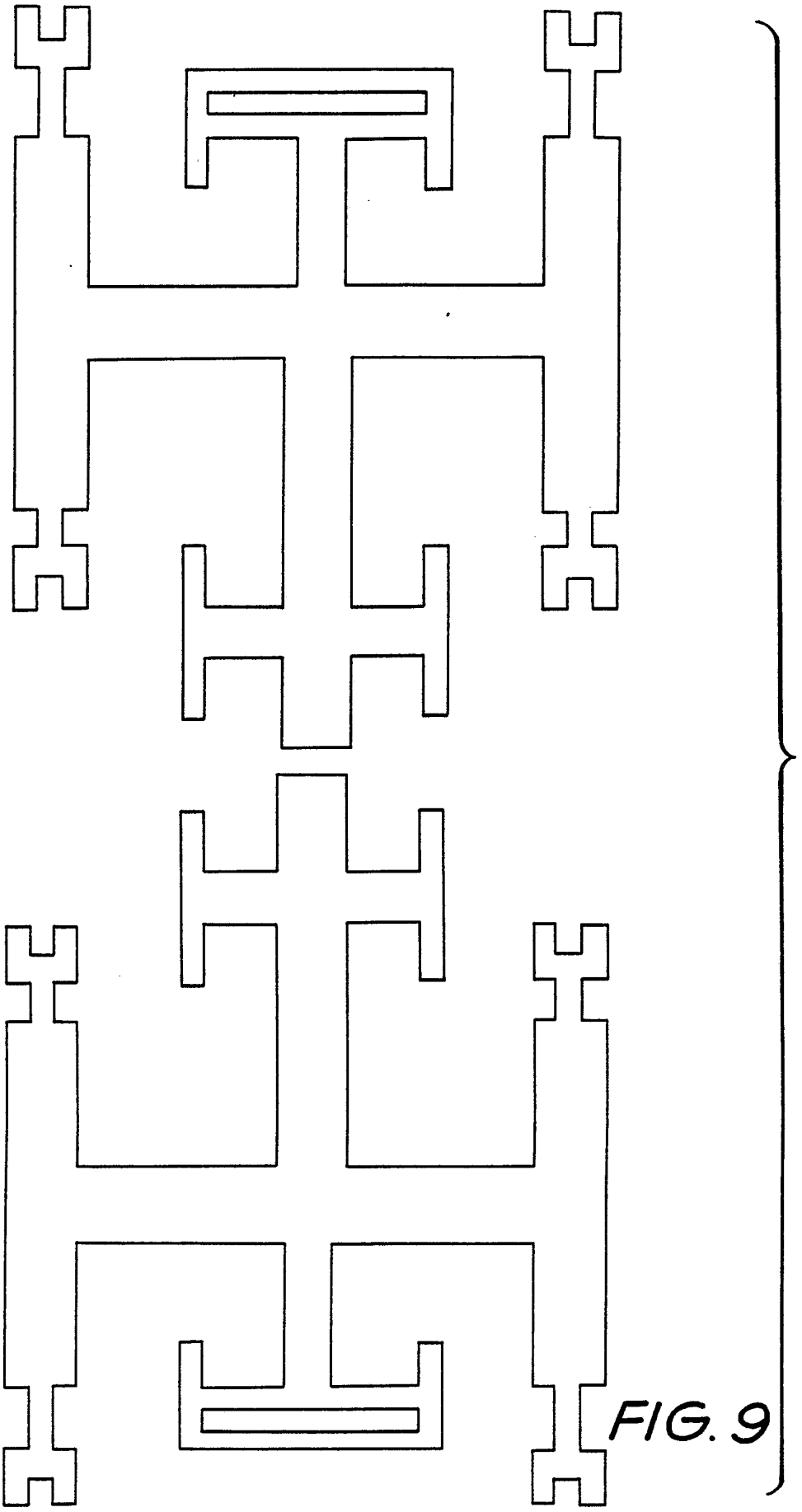

FIG. 9

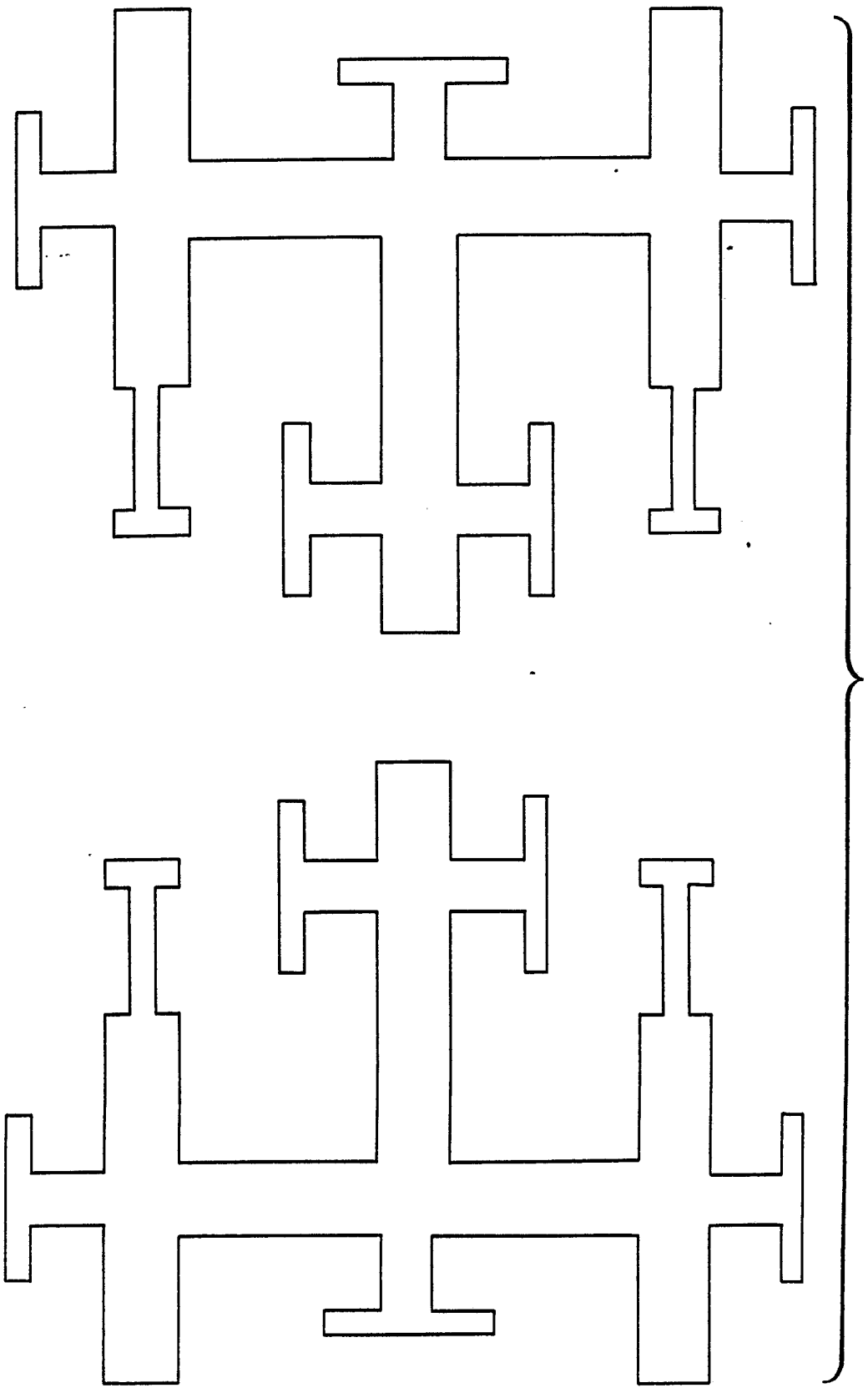

FIG. 10

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 88/00138

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)

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

Int. Cl.[4] H01Q 9/28, 1/36

II. FIELDS SEARCHED

Minimum Documentation Searched

Classification System	Classification Symbols
IPC	H01Q 9/28, 1/36

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	US,A, 3369245 (REA) 13 February 1968 (13.02.68)	(1-5, 26,28)
X	US,A, 2656463 (WOODWARD) 20 October 1953 (20.10.53)	(1-5, 26,28)
X	WO,A, 84/02038 (MEIER MESSTECHNIK) 24 May 1984 (24.05.84) See Fig. 4	(1,4,5,26)
X	EP,A, 12645 (HAVOT) 25 June 1980 (25.06.80)	(1,2,26)
X	DE,A, 2621452 (L'ETAT FRANCAIS REPRES-ENTE PAR LE DELEGUE MINISTERIEL POUR L'ARMEMENT) 25 November 1976 (25.11.76)	(1,26)
X	DE,A, 2164233 (RCA CORP) 13 July 1972 (13.07.72)	(1,26)
X	US,A, 3020550 (BEEVER) 6 February 1962 (06.02.62)	(1,26)

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search: 8 August 1988 (08.08.88)

Date of Mailing of this International Search Report: (23.08.88) 23 AUGUST 1988

International Searching Authority: Australian Patent Office

Signature of Authorized Officer: E.N. PERRIS

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 88/00138

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Members		
WO 8402038	AU 22673/83	DE 3242272	EP 124559
EP 12645	FR 2442520	US 4443805	
DE 2621452	FR 2311422	GB 1530703	US 4084162
DE 2164233	CA 930436 NL 7117966	FR 2120089	IT 946216

END OF ANNEX