

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 82301985.6

(51) Int. Cl.³: H 01 H 50/26

(22) Date of filing: 16.04.82

(30) Priority: 17.04.81 JP 54587/81
21.04.81 JP 56634/81

(43) Date of publication of application:
27.10.82 Bulletin 82/43

(84) Designated Contracting States:
BE DE FR GB IT NL

(71) Applicant: TAKAMISAWA ELECTRIC CO., LTD.
18-7, Kamiuma 3-chome
Setagaya-ku Tokyo(JP)

(72) Inventor: Fujii, Kunihiisa
2394-6, Nakagomimitsuya
Saku-shi Nagano-ken(JP)

(72) Inventor: Shikano, Yukio
904-8, Sarukubo
Saku-shi Nagano-ken(JP)

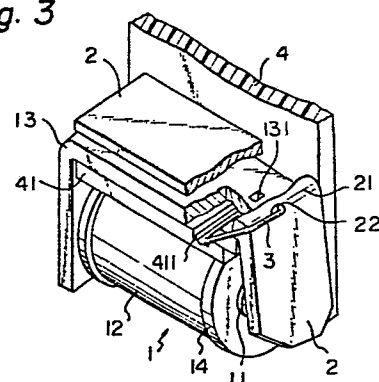
(72) Inventor: Tomono, Noboru
754, Oaza Shimogoe Usudamachi
Minamisaku-gun Nagano-ken(JP)

(74) Representative: Jackson, David Spence et al,
REDDIE & GROSE 16, Theobalds Road
London, WC1X 8PL(GB)

(54) Armature holding structure and hinge-spring used therein.

(57) An armature holding structure in an electromagnetic relay uses a hinge-spring in the form of a wire spring (3). One end (31) of the wire spring (3) is held in a hole (131) in the yoke (13) of the electromagnet (1) and the other end (35) of the wire spring (3) is held in a hole (22) in the armature (2) so that the pivot support structure for the armature (2) at the end of the yoke (13) is maintained by the wire spring (3). Since the hinge-spring (3) is of wire, the holes (131, 22) for its ends (31, 35) can be small, so that these holes (131, 22) have little effect on the magnetic reluctance of the armature (2) and the yoke (13).

Fig. 3



- 1 -

ARMATURE HOLDING STRUCTURE AND
HINGE-SPRING USED THEREIN

The present invention relates to an armature holding structure using a hinge-spring in an electromagnetic relay and the hinge-spring used.

In an electromagnetic relay of a relatively small size, for example 32 x 35 x 32 mm, an armature holding structure is used in order to support an armature rotatably on one end portion of the yoke of the electromagnet.

Examples of the prior art armature holding structure in an electromagnetic relay are illustrated in Figs. 1A, 1B, 2A and 2B. In the structures of Figs. 1A, 1B, 2A and 2B, the armature 2', having a rectangular aperture 23' and a groove 22', rides on one end of the yoke 13', having a rectangular aperture 132', of the electromagnet 1'. In order to maintain the pivot relationship between the armature 2' and the yoke 13', a hinge plate-spring 3' having the ends partly rolled under (Figs. 1A, 1B) or a hinge plate-spring 3" having several bent portions (Figs. 2A, 2B) bridges the groove 22' in the armature 2' and the rectangular aperture 132' of the yoke 13'. Such hinge plate-spring 3' or 3" is manufactured by the process of punching a planar plate having a predetermined size from a sheet and then working such punched planar plate to give either a shape in which the ends are partly rolled under (Figs. 1A, 1B) or a shape having several bent portions (Figs. 2A, 2B).

However, there are problems in the structure and the manufacturing process of the devices of Figs. 1A, 1B, 2A and 2B. First, the provision of the rectangular apertures 23' and 132' in the armature 2' and the yoke 13' causes each of the magnetic flux paths through the armature 2' and through the yoke 13' to become narrow, and hence the magnetic reluctances of the armature 2' and the yoke 13' are increased, and hence the magnetic efficiency of the magnetic path of the electromagnet 1' is diminished. If such diminution of the magnetic efficiency is not desirable, the entire size of the electromagnet must be increased, which does not comply

- 2 -

with the requirement for the reduction of the size of the electromagnetic relay.

Second, the process of attaching the hinge plate-spring 3' or 3" to the groove 22' and the rectangular aperture 132' requires specially skillful work, without which the preliminarily given shape and the preliminarily stored resilient force of the hinge plate-spring 3' or 3" are likely to be departed from so that uniformity of the operating characteristics of the produced electromagnet relays cannot be achieved.

Third, in the case where the hinge plate-spring 3' or 3" is manufactured by the process of punching a planar plate from a sheet having a large size in the longitudinal direction, which sheet has been manufactured by the rolling process, the degree of utilization of the sheet as a material for such punched planar plate cannot be increased. This is because the punching of the planar plate should be carried out so that the longitudinal direction of the hinge plate-spring coincides with the longitudinal direction of the sheet in order to ensure the metallurgical strength of the hinge plate-spring.

The structure of Figs. 2A, 2B is disclosed in Japanese utility model application laid-open No. 53-89541.

It is the main object of the present invention to provide an improved armature holding structure and a hinge useful for such armature holding structure, to achieve a reliable holding of the armature on the yoke, without diminishing the magnetic efficiency, by using a relatively simple and low-cost structure, eliminating the above described disadvantages in the prior art structures.

According to one aspect of the present invention, there is provided an armature holding structure using a hinge-spring in an electromagnetic relay comprising an electromagnet having a core, a coil and a yoke, an armature and a hinge-spring coupled to both said yoke and said armature, characterised in that the hinge-spring is a wire spring, one end of the hinge wire spring is held in a hole in the yoke, the other end of the hinge wire spring is held

- 3 -

in a hole in the armature, and the intermediate portion of the hinge wire spring passes through a groove in a member of the relay, along the side surfaces of the yoke and the armature and over the outer surface of the armature,

5 whereby a pivot support structure for the armature at the end of the yoke is maintained by the hinge wire spring.

According to another aspect of the present invention, there is provided a hinge-spring for use in an armature holding structure in an electromagnetic relay, 10 characterised in that the hinge-spring is a wire spring consisting of first, second, third, fourth and fifth portions, each of the first to fifth portions being arranged to form a predetermined angle with respect to the adjacent portion, the first and the fifth portions being 15 adapted to be inserted into respective holes in a yoke of an electromagnet and the armature of the electromagnetic relay, and the second and the fourth portions lying in the same plane, whereby the resilient force stored in the wire spring can be used for maintaining a pivot support 20 structure for the yoke and the armature.

The invention will now be described in more detail, solely by way of example, with reference to the accompanying drawings, in which:-

Figs. 1A, 1B, 2A and 2B illustrate two examples of 25 the prior art structure of an electromagnet relay;

Fig. 3 illustrates a perspective view of the electromagnetic relay having an armature holding structure embodying the present invention;

Fig. 4 illustrates the front view of the electro- 30 magnetic relay of Fig. 3;

Fig. 5 illustrates the longitudinal cross-section of the electromagnet in the device of Fig. 3;

Fig. 6 illustrates the lateral cross-section of the electromagnet in the device of Fig. 3; and

35 Fig. 7 illustrates a perspective view of the wire hinge-spring used in an embodiment of the present invention.

An electromagnetic relay using a wire hinge-spring for holding an armature in accordance with an embodiment of

the present invention is illustrated in a perspective view in Fig. 3. The detailed structures of the device of Fig. 3 are illustrated in Figs. 4, 5, 6 and 7.

The important portion of the device of Fig. 3 comprises an electromagnet 1 consisting of a core 11, a coil 12, a bobbin 14, a yoke 13, an armature 2, a wire hinge-spring 3 and a base block 4 having a shelf 41 projecting from the base block 4. Although not shown in the drawing, other elements of the electromagnetic relay are provided, such as a card, a movable contact spring, a fixed contact spring and a restoring spring to form a complete assembly of the elements of the electromagnetic relay. The motion of the armature 2 causes, via the card, the movement of the movable contact spring to cause the movable contact to come in contact with the fixed contact. Such complete assembly of the elements is encased in a housing consisting of the base block 4 and a cover (not shown).

The yoke 13 of the electromagnet 1 is fixed to the base block 4. The shelf 41 is provided for determining the position of the electromagnet 1 with respect to the base block 4. The armature 2 is pivoted at the inner corner thereof on the edge of the yoke 13. In order to maintain such a pivot support relationship between the armature 2 and the yoke 13, the wire hinge-spring 3 is provided to combine the armature 2 and the end portion of the yoke 13.

The wire hinge-spring 3 consists of a first 31, second 32, third 33, fourth 34 and fifth portion 35. The first portion 31 is held in a hole 131 in the yoke 13. The second portion 32 is held in a groove 411 in the shelf 41. The third portion 33 lies on the side surfaces of the shelf 41, the yoke 13 and the armature 2. The fourth portion 34 lies along the ridge 21 of the armature 2. The fifth portion 35 is held in a hole 22 in the ridge 21 of the armature 2. The wire hinge-spring 3 is made of, for example, stainless steel. The shape of the wire hinge-spring 3 is as shown in Fig. 7, wherein the second

portion 32 and the fifth portion 35 lie in the same plane. After the force F_2 is applied to the fourth and the fifth portions 34, 35 so as to deflect the fourth and the fifth portions 34, 35 outwardly with respect to the first and the second portions 31, 32, the resilient force F_1 which is exerted in the direction parallel to the direction of the third portion 33, causes the fourth and the fifth portions 34, 35 to be pressed inwardly toward the second portion 32. This resilient force F_1 acts as a combining force between the ridge 21 of the armature 2 and the end portion of the yoke 13.

The process in which the wire hinge-spring 3 is attached to the pivot structure between the armature 2 and the yoke 13 will be described below. First, the armature 2 is mounted at the inner corner thereof on the edge of the yoke 13. Then, the first and the second portions 31, 32 are inserted into the groove 411 and the shelf 41 until the first portion 31 is inserted into the hole 131 in the yoke 13. After the first and the second portions 31, 32 are inserted into the groove 411, the third portion 33 is moved clockwise along the side surfaces of the shelf 41, the yoke 13 and the armature 2, with the fourth and the fifth portions 34, 35 being simultaneously pressed outwardly by the force F_2 , thereby enabling the fourth and the fifth portions 34, 35 to go over the ridge 21 of the armature 21, until finally the fifth portion 35 is inserted into the hole 22 in the armature 2. Thus, the resilient force F_1 maintains the pivot relationship between the armature 2 and the yoke 13.

In the structure of Fig. 3 using the wire hinge-spring 3, the magnetic efficiency of the magnetic path of the electromagnet 1 is maintained satisfactorily. When the wire hinge-spring 3 is manufactured by the process of cutting a wire material, the degree of utilization of the wire material is a satisfactory one, because fundamentally no waste occurs in such cutting of the wire material.

Although a preferred embodiment is described hereinbefore, various modifications are possible within

- 6 -

the scope of the present invention. For example, although a groove 411 is provided in the shelf 41 in the embodiment of Fig. 3, it is possible to provide a groove in the inner surface of the yoke 13; also it is possible to provide
5 grooves in both the shelf 41 and the yoke 13.

CLAIMS

1. An armature holding structure using a hinge-spring (3) in an electromagnetic relay comprising an electromagnet (1) having a core (11), a coil (12) and a yoke (13), an armature (2) and a hinge-spring (3) coupled to both the yoke (13) and the armature (2), characterised in that the hinge-spring is a wire spring (3), one end (31) of the hinge wire spring (3) is held in a hole (131) in the yoke (13), the other end (35) of the hinge wire spring (3) is held in a hole (22) in the armature (2), and the intermediate portion (32,33,34) of the hinge wire spring (3) passes through a groove (411) in a member (41) of the relay, along the side surfaces of the yoke (13) and the armature (2) and over the outer surface of the armature (2), whereby a pivot support structure for the armature (2) at the end of the yoke (13) is maintained by the hinge wire spring (3).
2. An armature holding structure according to claim 1, characterised in that the relay includes a base block (4) having a shelf (41) formed perpendicular thereto, and the yoke (13) is fixed to the base block (4).
3. An armature holding structure according to claim 2, characterised in that the said member is the said shelf (41).
4. A hinge-spring for use in an armature holding structure in an electromagnetic relay, characterised in that the hinge-spring (3) is a wire spring consisting of first, second, third, fourth and fifth portions (31,32,33,34,35), each of the first to fifth portions being arranged to form a predetermined angle with respect to the adjacent portion, the first and the fifth portions (31,35) being adapted to be inserted into respective holes (131,22) in a yoke (13) of an electromagnet (1) and the armature (2) of the electromagnetic relay (1), and the second and the

fourth portions (32,34) lying in the same plane, whereby the resilient force stored in the wire spring (3) can be used for maintaining a pivot support structure for the yoke (13) and the armature (2).

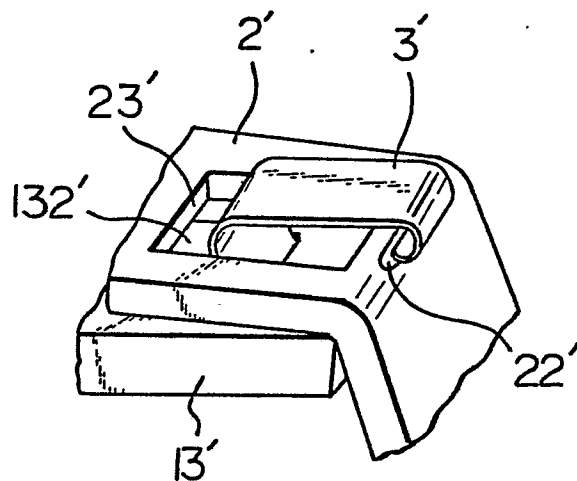
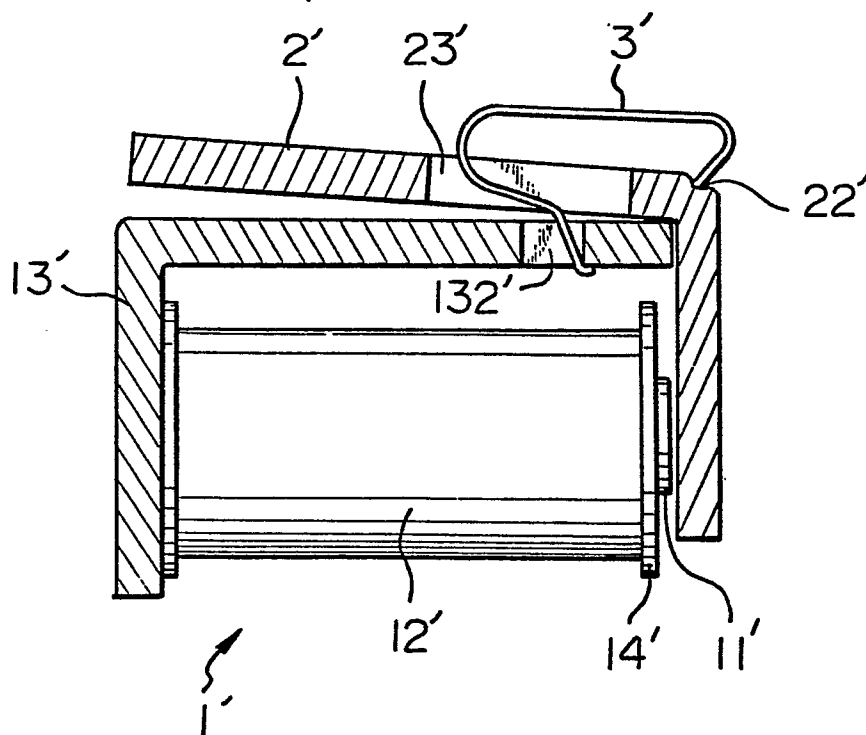
Fig. 1A*Fig. 1B*

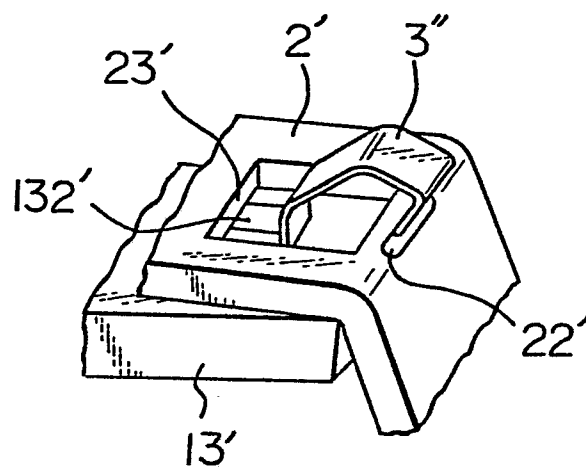
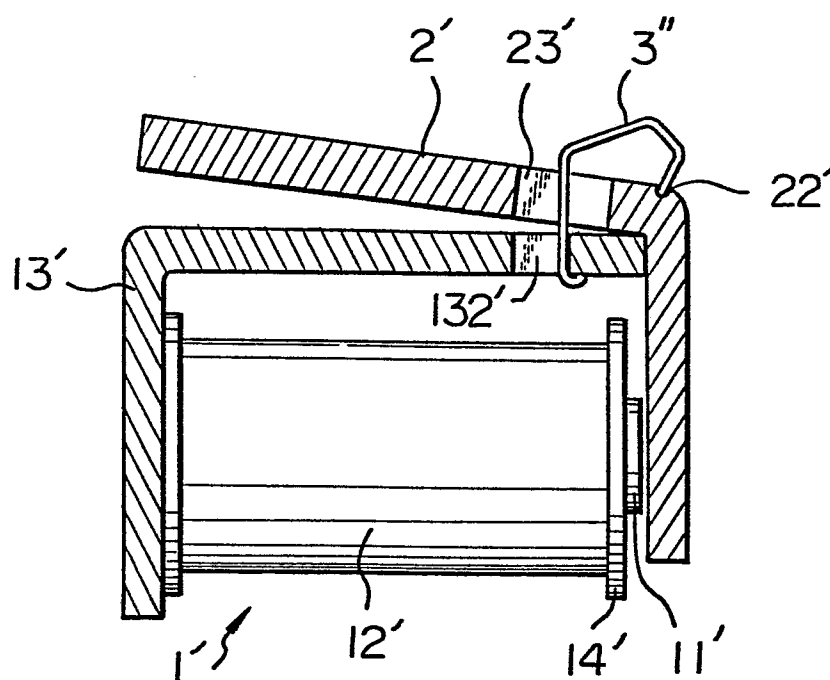
Fig. 2A*Fig. 2B*

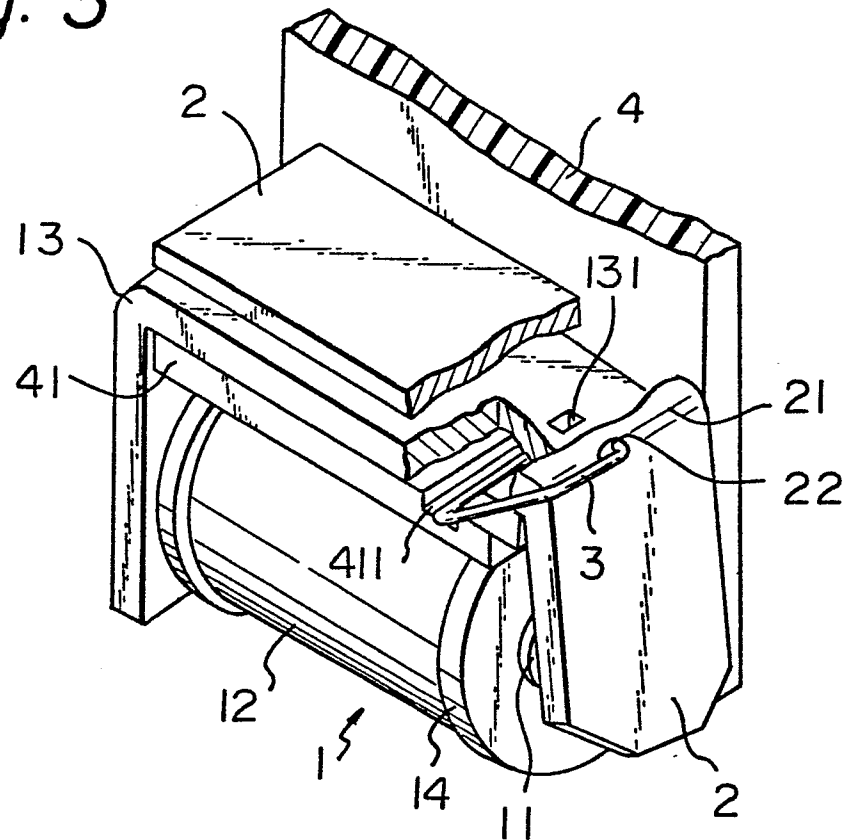
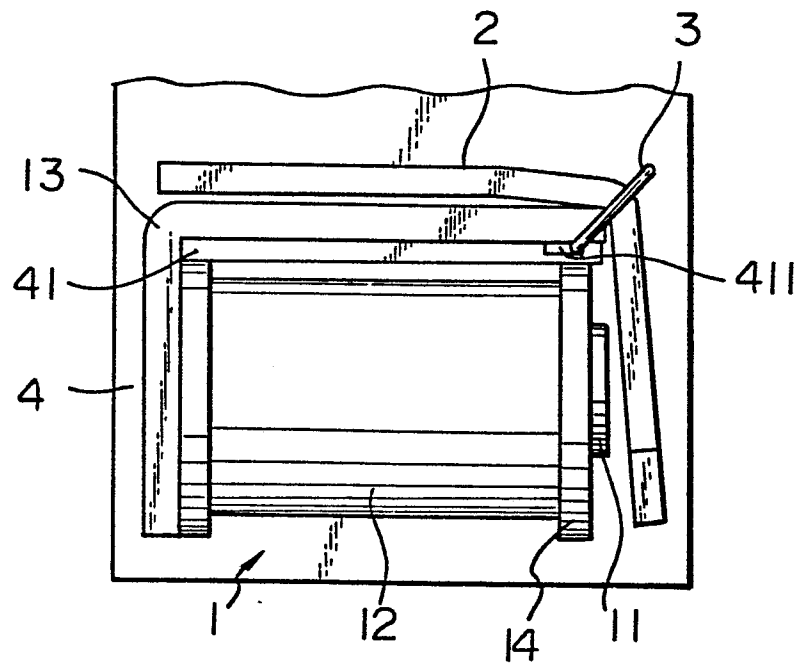
Fig. 3*Fig. 4*

Fig. 5

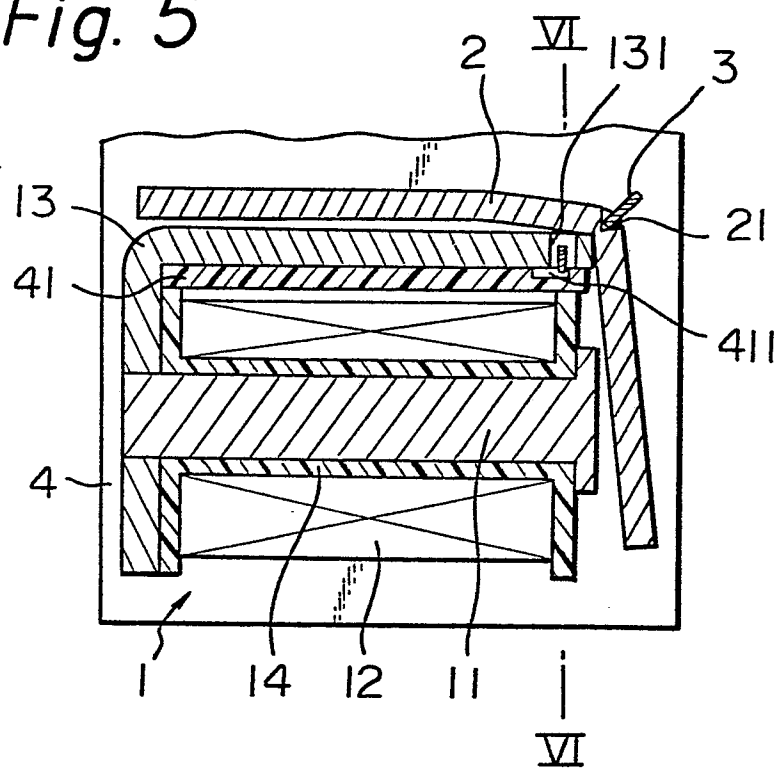


Fig. 6

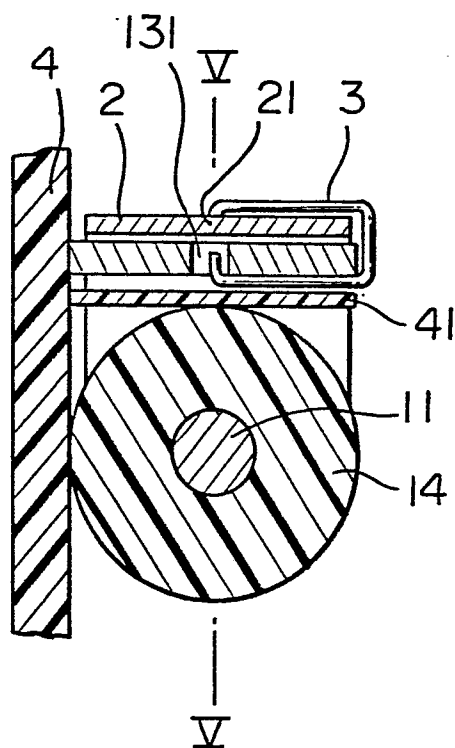


Fig. 7

