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

(11) Publication number: **0 248 528**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **87303858.2**

(22) Date of filing: **30.04.87**

(51) Int. Cl.³: **G 10 H 3/18**

(30) Priority: **03.05.86 GB 8610927**

(43) Date of publication of application:
09.12.87 Bulletin 87/50

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

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(54) **Pick-ups for string instruments.**

(57) An elongate film (32) of polyvinylidene fluoride or other polymeric piezoelectric material is provided on one face with an electrode (34) extending along approximately one-half the length of the film, and on the other face with a metallised screen layer (36) extending along the whole length. The film (32) is folded about the line M-M with the screen layer (36) to the exterior and inserted in a pocket-like cover (28) for securement to the instrument, for example by adhesive tape.

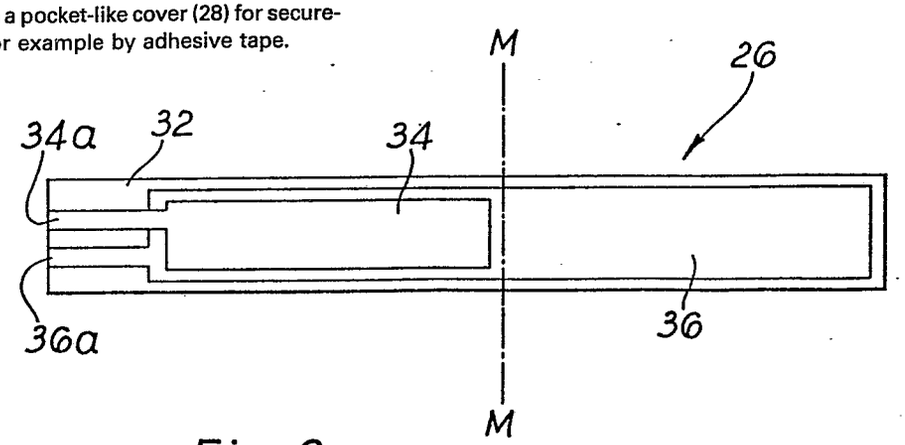

Fig. 2

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"Pick-ups for string instruments"

This invention relates to pick-ups for generating electrical signals from stringed instruments with bodies acting as resonant sounding boards, such as guitars, mandolins and violins.

It has previously been proposed to provide a pick-up for such an instrument by securing a ribbon of a polymeric piezoelectric material to the body of the instrument adjacent the strings. These prior proposals have suffered from various disadvantages including microphony effects caused by poor screening, and acoustic noise caused by movement of the connecting cable against the instrument body.

A principal object of the present invention is to provide a pick-up which is well screened from electromagnetic interference while providing a good level of output signal. In preferred embodiments, the invention also seeks to provide an improved connecting cable arrangement.

The invention accordingly provides a pick-up device for an instrument of the kind stated above, comprising an elongate sheet of a polymeric piezoelectric material, a metallised electrode formed on one face of said sheet and extending along not more than one-half the length thereof, and a metallised screen layer formed on the other face of said sheet and extending for substantially the whole length thereof, the sheet being folded over with the screen layer to the outside.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a pick-up according to the invention;

Fig. 2 is a plan view of a piezoelectric ribbon used in the pick-up of Fig. 1, seen before assembly;and

Fig. 3 is aperspective view of parts of the pick-up in the course of assembly.

Referring to Fig. 1, the pick-up comprises an assembly 10 the face of which visible in Fig. 1 is secured to the front panel of an acoustic guitar or other suitable instrument, suitably by double-sided self adhesive tape. The assembly 10 is connected by a cable 12 to a kach socket 14 forming part of a connector assembly 16.

The connector assembly 16 comprises an integral moulding of a resilient material, such as synthetic rubber, forming spaced blocks 18, 20 and a connecting web 22. The connecting web 22 is apertured at 24 in a manner suitable to allow the assembly 16 to be mounted on the bottom strap button of the guitar. The block 18 has a bore through which the cable 12 is threaded, the cable 12 being secured therein by epoxy adhesive. The cable 12 then passes in a loop to the jack socket 14 which is glued in a suitable cavity in the block 20.

This arrangement allows a lightweight cable of short length to be used between the pick-up transducer and the bottom of the guitar. Such cable may have relatively poor screening ability, but since only a short length is used this is not critical. A relatively heavy, well-screened cable (not shown) may then be used between the socket 14 and the amplifier, but with the arrangement described this does not impose a mechanical load on the pick-up, nor does it contact the guitar body.

The assembly 10 comprises a piezoelectric polymeric ribbon, generally designated at 26, within a cover 28, and an end cap 30. Referring to Fig. 2 , the ribbon 26 comprises a sheet 32 of polyvinylidene fluoride (PVDF) on one side of which an electrode 34 with connecting tab 34a is formed by printing with silver ink. On the reverse side, a screen layer 36 with connecting tab 36a is likewise formed by printing with silver ink.

It should be noted that the electrode 34 extends to a position short of the mid-length M-M of the sheet 32, and that the screen 36 is wider than the electrode 34.

To make the assembly 10, the sheet 32 is folded about the mid-line M-M to the condition shown in Fig. 3 with the electrode 34 to the inside. The electrode 34 is thus entirely enclosed within the screen 36. The central

conductor 38 of the cable 12 is then soldered to the electrode tab 34a, and the screen conductor 40 to the screen tab 36a. The area of the tabs is then covered with copper-coated self-adhesive tape 44, of a type which is readily available commercially, which is preferably electrically connected to the screen 36 as indicated at 46. Thereafter, this assembly is positioned within the cover 28, and the end cap is formed around these parts. The end cap 30 may be formed in situ as an injection moulding, or may comprise two injection moulded parts which clip together around the assembly.

A suitable form of material for the PVDF sheet 30 is KYNAR (trade mark) film from Pennwalt Corporation, preferably of 28μ thickness.

A preferred material is prepared as follows. A base film is prepared from vinylidene fluoride homopolymer, film grade resin (KYNAR 9816-30) by melt extrusion. The base film is uniaxially stretch oriented at a stretch ratio ranging between about 4 and 5 to 1to produce a film having a thickness of about 28μ. The film is then electrically polarized (poled) in known manner by subjecting the film to a pressure of about 300 psi, a temperature of about 65°C, and voltage of 15 - 18 kV. The temperature is held at 65°C for 10 minutes and the film is then permitted to cool at a rate of about 2°C/min over a period of 18 to 20 minutes. At the end of this cooling period, the voltage is decreased to zero and the film is removed and stabilised under a pressure of about 350-400 psi and temperature of 40-60°C.

The formation of the metallised layers 34, 36 is well understood in the art. Although silver ink printing is preferred for reasons of cost and convenience, other methods of metallisation well known in the art may be utilised.

The length of the electrode 34 is chosen to be approximately one-half the length of the PVDF ribbon 32 so that after folding there is a single layer of electrode

in the centre of the assembly. If the electrode were to extend along the whole length of the ribbon, the capacitance of the device would be greatly increased without any increase in signal strength; the device would also be much more sensitive to the stiffness of the instrument part to which it is attached, since bending movement of that part would produce equal and opposite voltages in the parts of the electrode on opposite sides of the fold line.

As seen in Fig. 2, the end cap 30 is provided with projecting fingers 42. These provide a finger grip for removing the assembly 10 from the instrument.

The cover 28, as shown in Fig. 3, is preferably formed by a sheet 48 of polyester film for securement to the instrument and a backing of woven fabric tape 50, these two being heat-sealed together around three edges to form a pocket. Preferably, the tape 50 is woven with transverse ribs, which obviates crinkling of the PVDF during handling; woven acetate transformer tape is suitable for this purpose.

CLAIMS

1. A pick-up device for a stringed instrument having a body acting as a resonant sounding board, the device comprising a piezoelectric element for securement to said body; characterised in that said element comprises an elongate sheet (26) of polymeric piezoelectric material, a metallised electrode (34) formed on one face of said sheet (26) and extending along not more than half the length of said sheet (26), and a metallised screen layer (36) formed on the other face of said sheet (26) and extending for substantially the whole length thereof, the sheet (26) being folded over with the screen layer (36) to the outside.

2. The device of claim 1, in which the screen layer (36) is wider than the electrode (34).

3. The device of claim 1 or claim 2, in which the ends of the sheet when folded are adjacent and are surrounded by a metallic screen (44).

4. The device of claim 3, in which said ends and said metallic screen (44) have an end cap (30) moulded around them.

5. The device of any preceding claim, including a pocket-shaped cover (28) in which said sheet (26) is received in folded condition.

6. The device of claim 5, in which said cover (28) comprises a fabric tape woven with transverse ribs.

7. A pick-up device in accordance with any preceding claim, in combination with a connector assembly (16) adapted for securement to a peripheral area of the instrument and a connecting cable (12) permanently secured to the device (10) and said connector assembly (16).

8. The combination of claim 7, in which the connector assembly (16) comprises a first portion (18) to which the cable (12) is secured, and a second portion (20) mounting a connector socket (14) and to which the cable (12) is also secured, the cable being disposed in a loop between said first and second portions.

9. The combination of claim 8, in which said first and second portions (18, 20) are joined by a web portion (22) adapted for attachment to a strap button.

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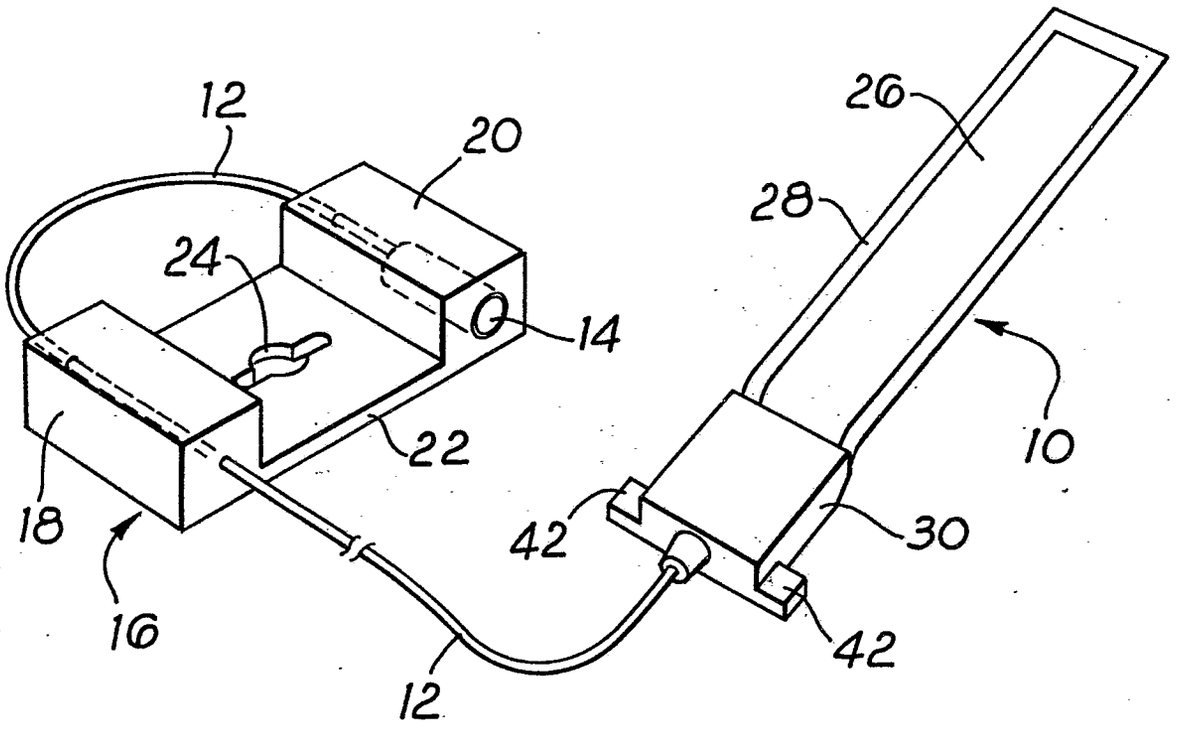

Fig. 1

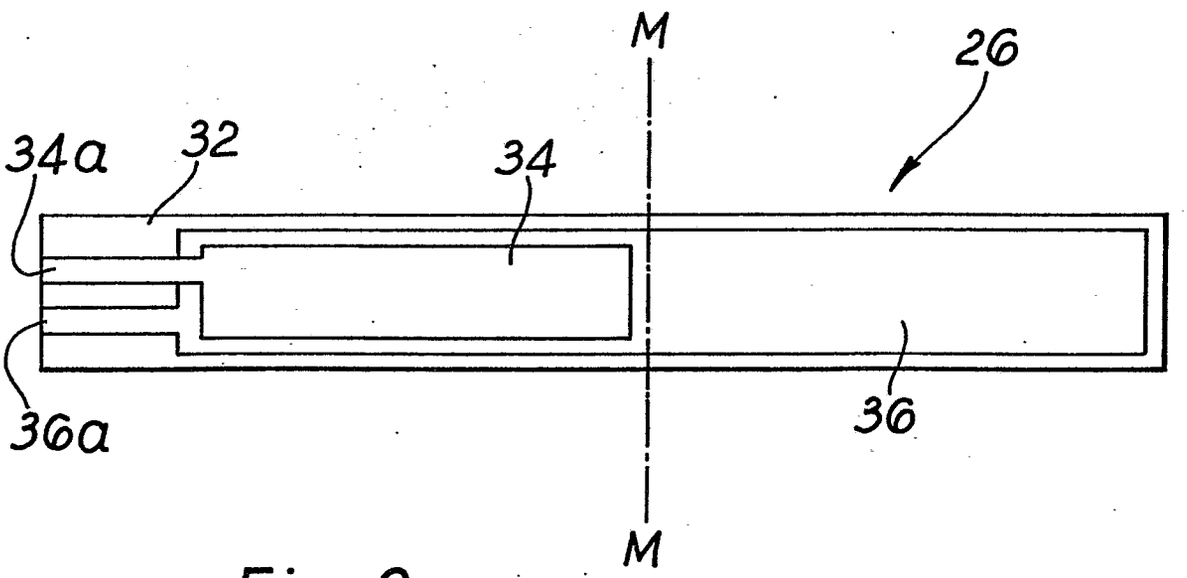

Fig. 2

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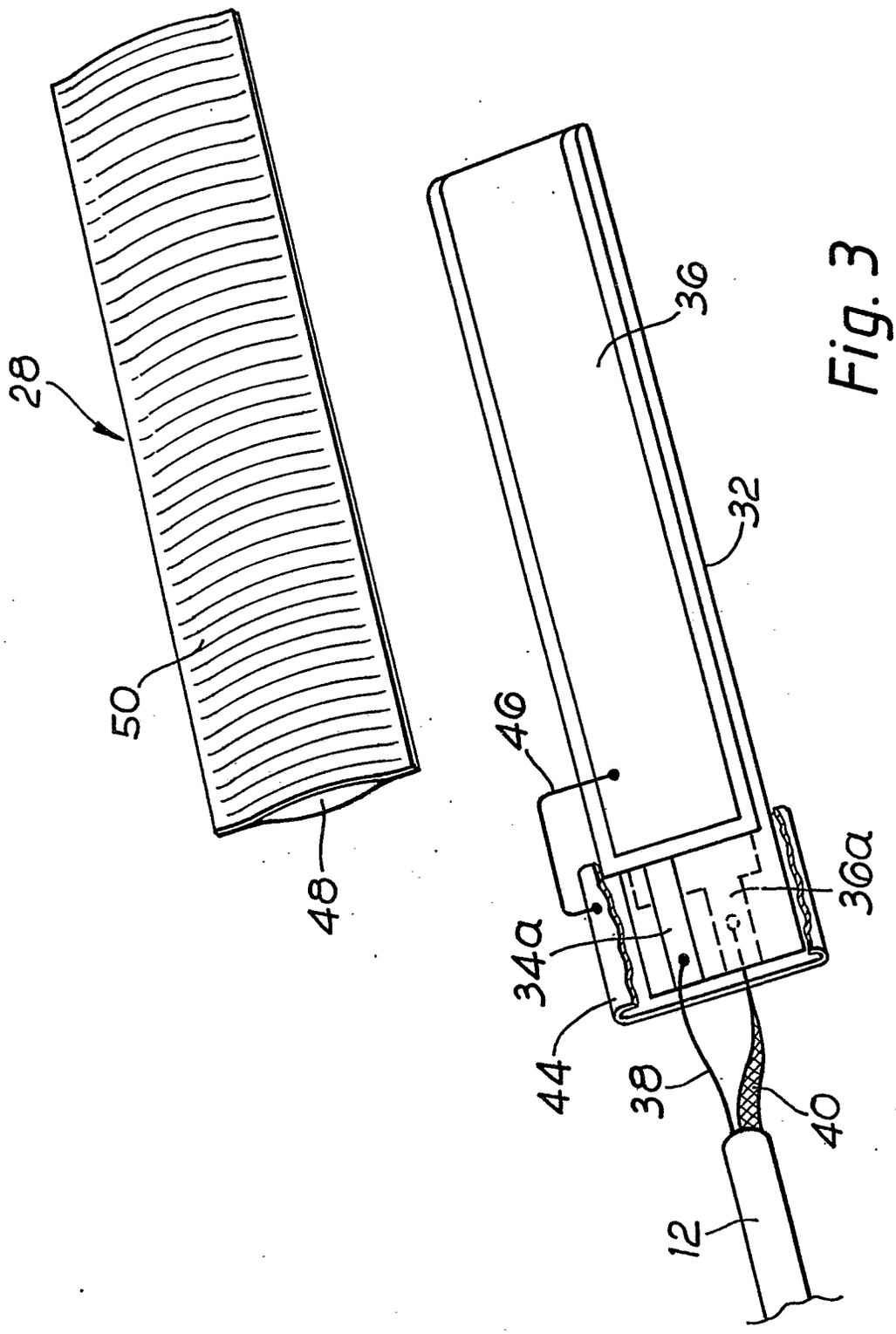

Fig. 3