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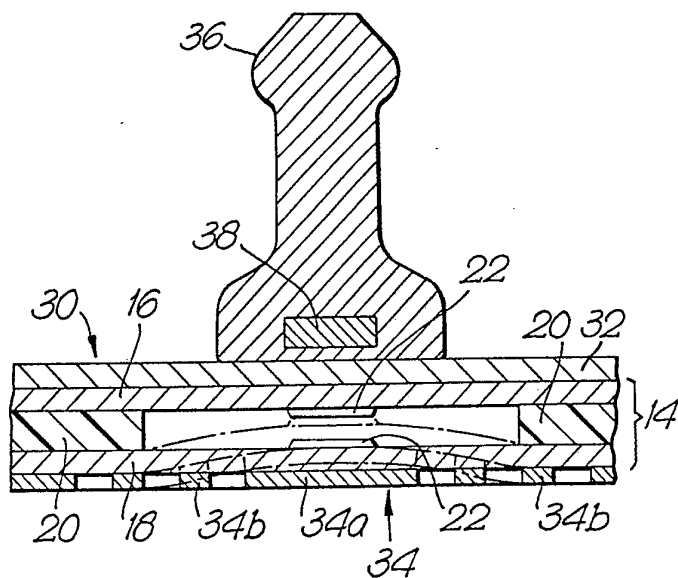
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(54) Game board for electronic games

(57) A game board (30) for electronic games such as electronic chess has a sensing sandwich (14) comprising upper and lower membranes (16, 18) which are normally held apart by an electrically insulating spacer (20), optionally of elastomeric material. The spacer has been formed by printing. The membranes have conductive regions (22) which contact one another to provide a closed electrical path when one or other membrane and/or the spacer deflect because of the presence of a playing piece (36). The deflection can be caused by the weight of the playing piece, or by the playing piece being pressed down by the player, or by the attraction of a magnet (38) in the playing piece to a metal plate (34) beneath the sandwich.

Fig. 6.



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Fig. 1.

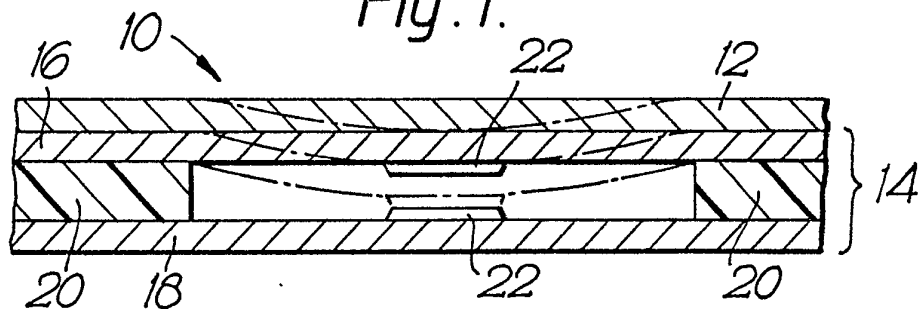


Fig. 2.

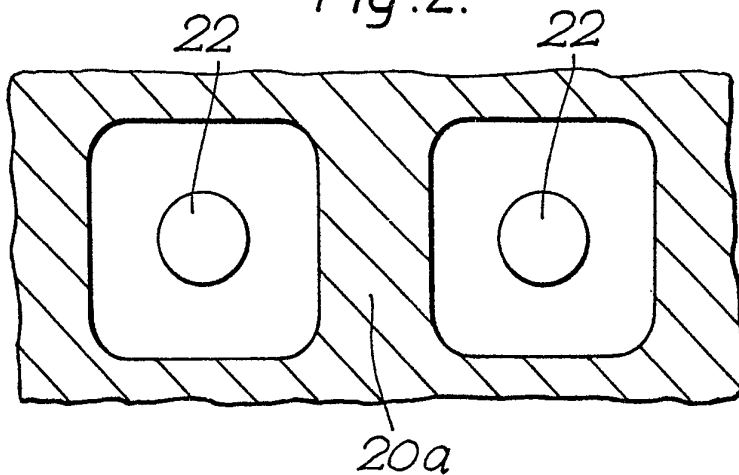


Fig. 3.

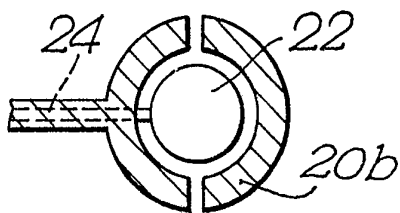


Fig. 4.

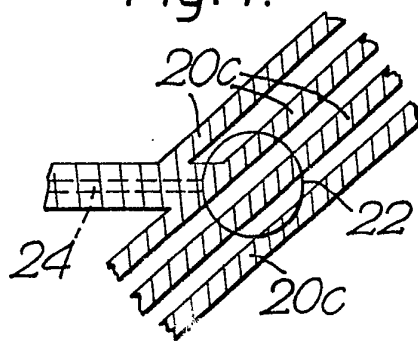
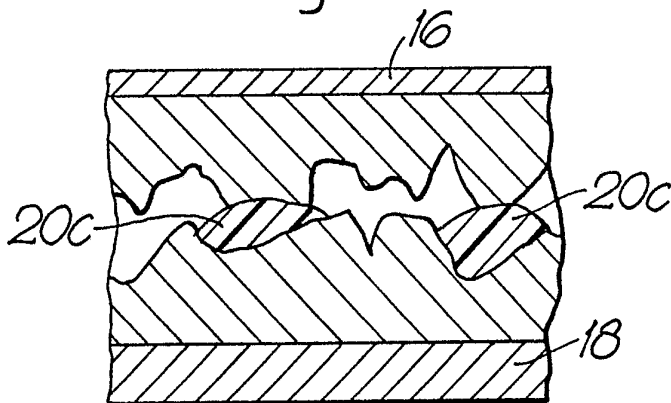
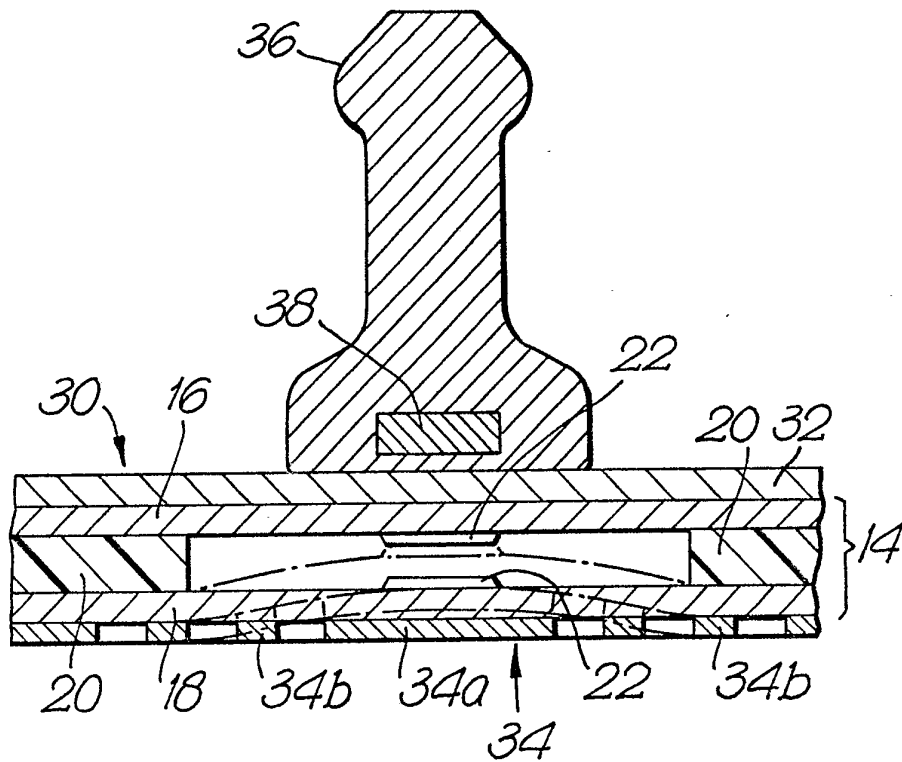


Fig. 5.



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Fig. 6.



## SPECIFICATION

**Improvements in electronic games**

5 This invention relates to electronic games, and in particular those games played by moving selected pieces over a board, e.g. chess.

For convenience hereafter reference will generally be made to chess. However, the invention is not limited to an electronic chess game but could equally well apply to shogi, draughts, checkers and so on. Accordingly, the term "chess" and references to the chessmen or chess pieces are to be construed to encompass other games where playing pieces are moved over a board and their particular pieces unless the content specifically requires otherwise.

In electronic chess one player will normally play against a pre-programmed computer device. An important feature of such an electronic version of chess is that the game should be played by the player in a manner which is as closely the same as manual chess as possible. Therefore the board should be sensitive to the positions of pieces and to moves and preferably should also be able to discriminate between different pieces. Also the feel of the pieces as they are moved should be as similar to manual chess as possible.

There have been various forms of sensor board, that is, a board which is sensitive to the positions of pieces. Of these one type which has achieved some commercial success is a pressure sensitive board.

One particular form of pressure sensitive board comprises an upper membrane constituting the board surface, a base sheet which may be identical to the upper membrane and a spacer positioned between them, the upper membrane and/or the spacer being flexible or resilient. The mutually facing surfaces of the upper membrane and base sheet are electrically conductive or have electrically conductive regions on them whilst the spacer has cut-outs corresponding to the board positions. Usually this resulting sandwich is covered by a decorative overlay, generally a rigid plastics sheets such as Lexan or PVC. The arrangement operates in a manner such that the circuit between the electrical contact regions of the upper membrane and base are open and not touching because the spacer keeps them apart. However, pressing upon the contact area with the base of a playing piece will cause deflection to bring about electrical contact to signal the presence of a piece.

Generally the spacer is glued or adhered to the base and upper membrane and for convenience is often a double-sided adhesive tape with the apertures die-stamped out. There are limitations on the thickness of such spacers, however, to enable them to be handled during assembly. This limits operating comfort and ease since the thicker the spacer the higher the closure force required.

The invention has been made with these aspects in mind.

According to the invention there is provided a board for an electronic game comprising an outer decorative sheet marked out with playing areas on which playing pieces are to be placed during the game, and beneath the outer sheet a sensing sand-

wich comprising upper and lower membranes whose mutually facing surfaces are normally held apart at least where those mutually facing surfaces of the membranes have electrically conductive regions by an electrically insulating spacer which may be of elastomeric material and which has been printed onto one or other membrane, the electrically conductive regions contacting one another to provide a closed electrical path when one or other or both membranes and/or the elastomeric spacer deflect inwardly of the sandwich, the deflection being caused by the presence of a playing piece, e.g. under the weight of a playing piece resting on a marked playing area, by pressure applied when a playing piece is moved to or from that playing area, or by the magnetic attractive force between one magnet and another magnet or a piece of magnetisable material one positioned beneath the membranes and the other positioned in the piece.

With such a board the spacer can be printed thinly onto one or other of the membranes and despite its thinness the problems of handling a thin spacer on its own are avoided. Therefore the spacer can be thinner than previously used separate spacers like double-sided adhesive tapes so reducing the operating forces required to cause the two membranes to come together and provide electrical contact. For example we have found that the force to give closure in a board according to the invention can be in the range of 5 to 35g instead of 30 to 210g and more typically 100 to 200g for a conventional board as described above.

The spacer can also be printed in such a manner that no totally closed regions are left between the two membranes, or in other words vents are provided, so that the operation of the board becomes independent of atmospheric pressure.

The spacer can be elastomeric material in which case the membranes can be relatively inflexible or could be a rigid material in which case at least one membrane should be flexible.

An example of a suitable elastomeric ink which can be printed, e.g. by silk screening, and then cured in situ is that sold by Grace Screen Inc under the trade name FX-3.

The membranes can be provided with electrically conductive regions by providing conductive areas on their inwardly directed surfaces, e.g. by printing with a conductive ink. These conductive regions can include contact pads which are to contact corresponding pads on the other membrane and conductive traces or leads forming connections to those pads. In the case of the latter these can be covered and insulated by the printed elastomer.

The printed elastomer can itself act as the glue to hold the two membranes together or a separate glue can be applied after the elastomer has cured. Where the elastomer itself is to act as the glue, some elastomer can be printed on one membrane and cured and then the remainder of the elastomer printed on that surface, the sandwich assembled by adding the second membrane and adhering the whole sandwich together by curing.

Because the printed spacer can be very thin, e.g. of a thickness of from 0.095 to 0.105mm, it need only be

provided in localised areas closely around or even partially over the electrical contact pads since it can readily be compressed if elastomeric to allow the pad on one membrane to contact the pad on the other membrane. Thus, whilst one can in effect print the spacer as a direct replacement of the separate spacer of conventional boards, one can as an alternative simply print a narrow contour of spacer around the periphery of the pad or even print say narrow spaced strips or spots of spacer over the pads, the remainder of the region between the membranes being left open or being filled with an optionally printed non-elastomeric insulating material. Therefore relatively small amounts of the printing ink to form the insulating spacer can be used with a consequent cost saving and an increase in user satisfaction since only low operating forces are required which reduces distraction to the user when making a move.

Examples of how the spacer may be printed in boards according to the invention are shown in the accompanying drawings.

Figure 1 shows the construction of a board according to the invention. It comprises a decorative overlay 12 carrying a pattern of say the 64 squares of a chess board. Beneath this is a sandwich 14 composed of an upper membrane 16 and a lower membrane 18. They are held apart and adhered to one another by an elastomeric spacer 20 which had been printed on the membrane 16. Also printed on the membranes 16 and 18 are electrically conductive pads 22. They are normally held apart by the spacer 20 but when a chess piece is pressed on or placed on a playing space, the overlay 12 and upper membrane become deformed as shown in broken lines and the conductive pads 20 make contact.

In one embodiment of the invention as shown in Figure 2 the elastomeric spacer 20a shown cross-hatched is printed as a more or less direct replacement of a conventional spacer around or near the edges of a playing square.

This is not essential however. For example it is only necessary for the elastomer to be printed over the area to be masked for electrical insulation, the leads or traces 24 and in the vicinity of the contours of the contact pads in the manner shown for the elastomer 20b shown cross-hatched in Figure 3.

In another embodiment shown in Figures 4 and 5, the elastomer 20c shown cross-hatched is not only printed as an electrical insulator on the traces or electrical connectors, but also as a very sparse pattern on the contact pad 22 itself. Again, this relies on the elastomer to yield. It makes use of the granularity in the ink's surface to provide electrical contact when the two membranes are pressed together. The individual blobs of elastomer are small, and the blob-to-blob spacing is also small, yet blobs are sufficiently large to be easily printed. The deformation is very tiny, so excellent control of the operating force is possible. The economy of ink and of elastomer is substantial.

Once the elastomer has been cured, an adhesive is printed onto unoccupied spaces. The spots are judiciously chosen to provide support to the sandwich top and hence to the overlay, yielding best possible overlay appearance. The adhesive may well be elas-

tomeric again, to ensure even thickness.

Because relatively low electrical circuit closing forces are possible with a board structure according to the invention, magnetic attraction may be used to provide positive and reliable closing of the electrical circuit. In the past, magnets have been provided in the base of chess pieces and a magnet positioned beneath each playing square. Provided the magnets are all arranged correctly, and this is a troublesome manufacturing step, the piece and square magnets will attract one another when a playing piece is positioned on a square and so cause the two membranes of the board to be squashed together to close the electrical circuit. The attractive force is high and this detracts from the natural feel of placing a playing piece on a square or removing it and also tends to deform the surface of the board with time.

An alternative board which has been proposed has a reed switch beneath each square and the playing pieces have a magnet in their bases. The orientation of the magnet is not critical but the cost of the reed switches is high, their assembly to the board is a time consuming and so expensive step, and they are delicate items which are easily damaged.

According to the invention in another aspect therefore there is provided a board and associated playing pieces, the board having beneath it a sensing sandwich comprising upper and lower membranes whose mutually facing surfaces are normally held apart at least where those mutually facing surfaces of the membranes have electrically conductive regions by an electrically insulating spacer which may be of elastomeric material, the electrically conductive regions contacting one another to provide a closed electrical path when one or other or both membranes and/or the elastomeric spacer deflect inwardly of the sandwich, the deflection being caused by the presence of a playing piece and a magnet either in the base of the playing or under the square and a piece of ferromagnetic material under the square or in the piece, respectively, the resulting magnetic attraction promoting the deflection inwardly of the sandwich by the presence of a playing piece.

The low closure forces of a board as described previously with the printed spacer make such a board ideal for use with this other aspect of the invention. Thus the resulting relatively low magnetic attraction will still ensure reliable closure without being a distraction. Also the orientation of the magnet is irrelevant. Further the cost is low in comparison with the use of reed switches.

Preferably the magnet is placed in the base of the or each playing piece and a continuous flexible sheet or individual pieces of a magnetisable sheet are placed under the lower membrane. Then, the top decorative overlay can be quite stiff and non-deformable, for example the overlay could be a wooden chess board, yet reliable electrical contact closure can still be achieved by drawing the lower membrane upwardly under the magnetic attraction in the presence of a playing piece. One advantage of this embodiment is that the decorative overlay can comprise a circuit board carrying on its underside a printed circuit to control small LED's whose illumination can be

used to indicate moves on the board itself.

An example of a board and associated pieces according to this aspect of the invention is shown in Figure 6.

5 The board 30 has a stiff upper decorative overlay 32. Beneath this is a sandwich 14 which is identical to the sandwich 14 described in connection with Figure 1 to which reference is made for its construction and operation.

10 Beneath the sandwich is a thin metal plate 34 of mild steel or other magnetisable material. It has been made flexible by a stamping operation whereby a central disc 34a is defined and supported by a coiled strip 34b from the main body of the plate 34. Thus  
15 this disc 34a can move upwardly and deflect the membrane 18 upwardly in response to magnetic attraction as explained below.

A playing piece 36 is shown positioned on the overlay 32. This contains a small magnet 38 embed-  
20 ded within the piece near or at its base. As shown by the broken lines, the resulting magnetic attraction between the plate 34 and the magnet 38 deforms the membrane 18 upwardly so that the conductive pads 22 make contact to signal the presence of a playing  
25 piece 36.

The invention also extends to the combination of boards as described with the electronics and software to provide an electronic chess game.

### 30 CLAIMS

1. A board for an electronic game comprising an outer decorative sheet marked out with playing areas on which playing pieces are to be placed dur-  
35 ing the game, and beneath the outer sheet a sensing sandwich comprising upper and lower membranes whose mutually facing surfaces are normally held apart at least where those mutually facing surfaces of the membranes have electrically conductive re-  
40 gions by an electrically insulating spacer which may be of elastomeric material and which has been printed onto one or other membrane, the electrically conductive regions contacting one another to provide a closed electrical path when one or other or both  
45 membranes and/or the elastomeric spacer deflect inwardly of the sandwich, the deflection being caused by the presence of a playing piece.

2. A board as claimed in Claim 1 in which the deflection to cause the electrically conductive regions to  
50 contact one another is caused by the weight of a playing piece resting on a marked playing area.

3. A board as claimed in Claim 1 in which the deflection to cause the electrically conductive regions to contact one another is caused by the pressure ap-  
55 plied as a playing piece is moved to or from a marked playing area.

4. A board as claimed in Claim 1 in which the deflection to cause the electrically conductive regions to contact one another is caused by the magnetic attrac-  
60 tive force between one magnet and either another magnet or a piece of magnetisable material, one positioned beneath the membranes and the other positioned in the piece.

5. A board as claimed in any preceding claim in  
65 which the insulating spacer has been printed in such

a manner that no totally closed regions are left between the two membranes.

6. A board as claimed in any preceding claim in which the insulating spacer is of an elastomeric material and the membranes are of relatively inflexible material.

7. A board as claimed in any of claims 1 to 5 in which the insulating spacer is of a rigid material and at least one membrane is of flexible material.

75 8. A board as claimed in any preceding claim in which the electrically conductive regions have been provided on the inwardly directed surfaces of the membranes by printing with an electrically conductive ink.

80 9. A board as claimed in any preceding claim in which the printed insulating spacer additionally functions as a glue to hold the two membranes together.

10. A board as claimed in any preceding claim in which the insulating spacer has been printed as a  
85 narrow contour around the periphery of the electrically conductive regions which are to contact one another.

11. A board for an electronic game substantially as herein described with reference to Figure 1 or  
90 Figure 1 as modified by Figure 2, Figure 3, or Figures 4 and 5, of the accompanying drawings.

12. A board and associated playing pieces, the board having beneath it a sensing sandwich comprising upper and lower membranes whose mutu-  
95 ally facing surfaces are normally held apart at least where those mutually facing surfaces of the membranes have electrically conductive regions by an electrically insulating spacer which may be of elastomeric material, the electrically conductive regions  
100 contacting one another to provide a closed electrical path when one or other or both membranes and/or the elastomeric spacer deflect inwardly of the sandwich, the deflection being caused by the presence of a playing piece and a magnet either in the base of the  
105 playing piece or under the square and a piece of ferromagnetic material under the square or in the piece, respectively, the resulting magnetic attraction promoting the deflection inwardly of the sandwich by the presence of a playing piece.

13. A board and associated playing pieces as claimed in Claim 12 in which the board is a board as claimed in any of claims 1 to 11.

14. A board and associated playing pieces as claimed in Claim 12 or Claim 13 in which a magnet is  
115 placed in the base of the or each playing piece and a continuous sheet or individual pieces of a magnetisable sheet are placed under the lower membrane.

15. A board and associated playing pieces as claimed in any of claims 12 to 14 in which the board  
120 has a top decorative overlay which is stiff and non-deformable and comprises a circuit board carrying on its underside a printed circuit to control LED's whose illumination is used to indicate moves on the board.

16. A board and associated playing pieces substantially as herein described with reference to  
125 Figure 6 of the accompanying drawings.

17. An electronic game comprising a board as claimed in any of claims 1 to 11 and associated play-  
130 ing pieces or a board and associated playing pieces

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as claimed in any of claims 12 to 16, together with the electronics and software.

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