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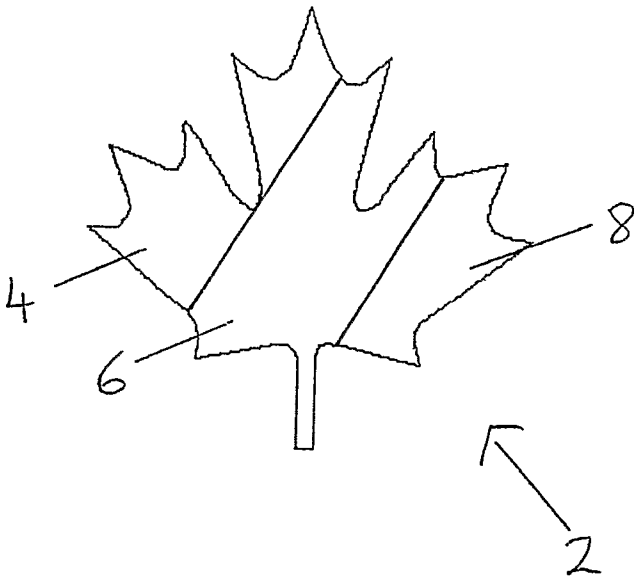
(54) **Title:** PLANCHETTE FOR USE IN COUTERFEIT PROTECTION



(57) **Abstract:** Planchettes for inclusion in paper products, such as bank notes, are described. The planchettes comprise one or more coloured regions that are visible only under ultra-violet light. The planchettes have shapes that are complex or have features such as indentations, projections and lobes. In some forms, the planchettes form multi-sided symbols, such as national symbols.

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Planchette For Use in Counterfeit Protection

The present invention relates to planchettes for inclusion in paper products for anti-counterfeiting purposes.

It is known to provide a number of paper products, such as bank notes, cheques, passports, identity papers and fiduciary papers, with some form of counterfeit protection. A number of counterfeit protection measures are known in the art. They include watermarks, holograms, the provision of metallic strips through the paper, the use of fluorescent particles and the use of optically variable inks and coatings.

Problems with known counterfeit protection measures include the expense of some options and the ease with which some options can be overcome, for example by utilizing methods including digital or laser printing, scanning, photography and xerography. Another problem is the difficulty in raising public awareness of some of the measures, especially in relation to counterfeit protection for bank notes.

One known solution is to incorporate a number of small discs of coloured paper, known as planchettes, into a paper product and to use the visual effect generated by the planchettes as an anti-counterfeiting measure. Such arrangements offer many advantages, but suffer from problems including the ease with which some schemes can be replicated by printing, and the need to educate users to check for the presence of the planchettes.

It is an object of the present invention to provide an alternative means of providing counterfeit protection that addresses at least some of the above-mentioned problems.

The present invention provides a planchette for inclusion in a paper product, the planchette comprising one or more regions, wherein said regions are coloured and the colours are visible only under ultra-violet light, and wherein said planchette has a complex shape.

The present invention also provides a method of manufacturing planchettes, the method comprising the steps of forming (for example by printing) one or more regions on a paper or other substrate (such as polymer, cellulose or combination of thin laminar materials), wherein said regions are coloured and the colours are visible only under ultra-violet light, the method further comprising the step of forming the substrate into a plurality of planchettes, each having a complex shape. The substrate may be formed into a plurality of planchettes by punching or stamping. Alternatively, the planchettes may be formed by cutting, for example micro-cut planchettes may be generated. Alternatively, the planchettes may be formed by printing or foiling onto a transparent substrate.

The complex shape of the planchettes may take many different forms. For example, in one embodiment of the invention, the planchette has the shape of a maple leaf. In other forms of the invention, the planchette has the shape of other multi-sided symbols. The term "complex shape" excludes simple shapes such as squares, rectangles and circles and is intended to encompass more complex shapes that might, for example, include one or more projections, one or more indentations, and/or one or more lobes.

The present invention also provides a planchette for inclusion in a paper product, the planchette comprising one or more regions, wherein said regions are coloured and the colours are visible only under ultra-violet light, and

wherein said planchette has a shape having one or more indentations, protections and/or lobes.

The present invention further provides a method of manufacturing planchettes, the method comprising the steps of forming (for example printing) one or more regions on a paper or other substrate (such as polymer, cellulose or combination of thin laminar materials), wherein said regions are coloured and the colours are visible only under ultra-violet light, the method further comprising the step of forming the substrate into a plurality of planchettes, each having one or more indentations, protections or lobes. The substrate may be formed into a plurality of planchettes by punching or stamping. Alternatively, the planchettes may be formed by cutting, for example micro-cut planchettes may be generated. Alternatively, the planchettes may be formed by printing or foiling onto a transparent substrate.

The present invention further provides a planchette for inclusion in a paper product, the planchette comprising one or more regions, wherein said regions are coloured and the colours are visible only under ultra-violet light, and wherein said planchette has the shape of a multi-sided symbol.

The present invention also provides a method of manufacturing planchettes, the method comprising the steps of forming (for example printing) one or more regions on a paper or other substrate (such as polymer, cellulose or combination of thin laminar materials), wherein said regions are coloured and the colours are visible only under ultra-violet light, the method further comprising the step of forming the substrate into a plurality of multi-sided symbols. The substrate may be formed into a plurality of planchettes by punching or

stamping. Alternatively, the planchettes may be formed by cutting, for example micro-cut planchettes may be generated. Alternatively, the planchettes may be formed by printing or foiling onto a transparent substrate.

By providing planchettes in the form of a multi-side symbol, the planchette can be made readily identifiable to a lay person. As noted above, a problem with some prior art anti-counterfeiting measures is the difficulty in raising public awareness of some of the measures, especially in relation to counterfeit protection for bank notes. The present invention addresses this problem by providing planchettes in the form of symbols that are readily recognisable by members of the public.

Planchettes which can be readily seen by a lay person can provide an effective overt security feature. It is also possible to provide planchettes in accordance with the present invention that are difficult to see with the naked eye and therefore provide a covert security feature. Furthermore, planchettes which are not visible under normal lighting conditions may be considered to provide a covert security feature.

The shape of said planchettes in the various aspects of the invention described above may be non-rectilinear, non-circular and/or irregular. In the preferred forms of the invention, the shape of the planchettes is both non-rectilinear and non-circular. In many, but not all, forms of the invention, the shape of the planchettes is non-rectilinear, non-circular and irregular.

The planchette may take one of many forms. In one form of the invention, the symbol is associated with a country, such

as a maple leaf for Canada, or a fern for New Zealand. This is particularly useful for banknotes. Adding planchettes in the shape of a maple leaf to Canadian bank notes, for example, provides an anti-counterfeiting measure that is readily identifiable by the general public. Similarly, the shape of the planchette could take the form of the outline of a country. Other exemplary shapes include heart shapes, star shapes, coats of arms and abstract shapes.

The planchette may comprise a plurality of regions, such as a repeating pattern of regions. Further, said regions may be striped regions, which may form a repeating pattern. In one form of the invention, said striped regions are diagonal striped regions. In forms of the invention in which the shape of the planchette can be considered to be a symbol, the striped regions may be diagonal relative to that symbol.

By providing a plurality of coloured regions on the planchette, the coloured regions can be made, in effect, to define the shape of the planchette. This is relatively easy to generate if the colours are printed onto a substrate and the planchette formed from the substrate, for example by stamping or cutting. However, this effect is difficult to replicate by printing alone, since the precision required to print coloured regions that define the shape of the symbols required is not trivial. Accordingly, the provision of a plurality of coloured regions on the planchette provides significant protection against counterfeiting by printing.

Furthermore, the colour may be selected to match the shape in some way, for example in order to aid recognition by the general public. For example, in forms of the invention in which the shape of the planchettes can be considered to be symbols, the colours of the coloured regions can be chosen so

that they relate to the symbols. For example, in the event that national symbols are chosen, the colours may be the national colours of the relevant countries.

The regions or stripes may be placed at about 1mm gradations. The width of the stripes can be more or less than 1mm, but it has been found that 1mm results in a particularly effective optical effect when the planchettes are incorporated into a paper product. Hence, a width of the order of 1mm (0.5 to 1.5 mm) may advantageously be chosen since it offers good counterfeit protection.

In one form of the invention, the regions are printed on the front and rear sides of the planchette such that regions on the front and rear sides are in register with one another and have the same colour. This ensures that, if the planchettes are incorporated into a paper product, the printed regions will be visible, given the appropriate light conditions, regardless of the orientation of the planchette in the paper product. In an alternative form of the invention, the regions are printed on one side of the planchette in such a way that the print is visible on both sides of the planchette. By way of example, this effect may be achieved by forming the planchette from sufficiently thin paper.

The said colours may include a plurality of different colours. The regions may abut one another with no overlap of colour at the boundaries of the regions. The pigments used for generating the printed stripes do not generally combine well, hence the desire to prevent the printed stripes from overlapping. Further, if the planchettes are incorporated into a paper product, the provision of fluorescent printed stripes that abut against one another exactly results in a pattern that is difficult to replicate, thereby offering good

counterfeit protection. In addition to, or instead of, coloured regions, planchettes in accordance with the invention may include thermochromic, photochromic, magnetic and/or infra-red coatings.

In some forms of the invention, said one or more regions are formed on said substrate in a manner other than printing. For example, the regions may be formed from different coloured foils.

The planchettes may have a combination or layered security comprising of covert, forensic and overt features. For example in one embodiment the shape is cut from an opaque material such that when it is viewed in transmitted light, i.e. held up to the light, then the shape is clearly visible in what is called the 'look through'. In other words the intricate detail of the shape is seen in a similar manner to a watermark. The shape may contain intricate cut-outs, voids and graduated opacity to provide a distinct visual characteristic which is different from a watermark. In conjunction with this the substrate can then be printed with, for example, fluorescent inks which will only be visible under ultraviolet light or thermochromic inks, which react to temperature so that they either appear or disappear, photochromic inks which appear or disappear when exposed to light or other inks which provide a forensic check whereby a more sophisticated means of detection is required, for instance infra-red and anti-stokes pigments. Thus it is possible to have one single security element that embodies all three levels of security and detection.

The said planchette may have a maximum dimension of 5mm. However other dimensions, such as maximum dimensions of 2mm,

3mm, 4mm or 6mm, are possible.

In one form of the invention, the planchette has a different density to the paper into which it is intended to be incorporated. This allows the planchette to be seen in the so-called "look through" of the paper. The effect is similar to viewing a watermark and is not possible to replicate by printing.

The planchette may be a multi-layered material such that the outer faces are made from paper or some other material compatible with papermaking, whilst the inner layer is made of an opaque material so that in transmitted light, the planchette appears as a type of watermark in the base paper or other substrate. In an alternative form of the invention, the outer layer of the planchette described above is omitted so that just the opaque material is provided. In such an arrangement, the opaque material will need to be compatible with the papermaking process such that the material forms part of the final paper product.

Thus, in many forms of the invention, the planchettes that are incorporated into a paper product in accordance with the principles of present invention are invisible in reflected light, but visible in transmitted and/or ultra-violet light.

The planchette may be tissue paper or an alternative thin paper. The paper may be provided without optical brighteners.

A planchette in accordance with the present invention may have a layer of varnish applied to the outer surface of the planchette. The layer of varnish may be applied to protect the printed stripes or regions against abrasion and/or to

improve the affinity of the planchettes with a paper product into which the planchette is incorporated.

The present invention also provides a method of manufacturing a paper product, the method comprising the steps of mixing one or more planchettes as described above with slurry paper pulp and forming the paper pulp and planchette mix into a continuous web of paper.

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

Figure 1 shows a planchette in accordance with an embodiment of the invention;

Figure 2 shows a planchette in accordance with an embodiment of the invention;

Figure 3 shows a planchette in accordance with an embodiment of the invention;

Figure 4 shows a planchette in accordance with an embodiment of the invention;

Figure 5 is a cross-section of a planchette in accordance with an embodiment of the invention; and

Figure 6 shows a planchette in accordance with a further embodiment of the invention.

Figure 1 shows a planchette, indicated generally by the reference numeral 2, in accordance with an embodiment of the present invention. The planchette 2 is in the shape of a maple leaf, the national symbol of Canada. The planchette includes stripes 4, 6 and 8 each extending diagonally across the planchette 2. The planchette 2 is small, typically having a maximum dimension of between 2mm and 5mm.

Each of the stripes 4, 6 and 8 has a fluorescent colouring that is only visible under ultra-violet light. The stripes 4 and 8 are coloured red; the stripe 6 is coloured white. Red and white are, of course, the colours of the Canadian flag.

In one embodiment, the colours are visible when ultraviolet light having a wavelength between 245nm and 365nm is shone at the planchette. In any particular embodiment, and for any particular colour, the wavelengths at which the colours are visible are dependent on the pigments used to generate the prints.

A large number of planchettes, such as the planchette 2, can be cut from a single sheet of paper. The coloured stripes are printed onto the paper prior to the planchettes being cut. The coloured stripes are printed on both sides of the planchette and are exactly in register such that each colour appears exactly over the corresponding colour on the other side of the planchette. Further, the coloured stripes abut one another such that there is no overlap of colours at the boundary of the stripes.

As noted above, the planchettes in accordance with the present invention are intended to be incorporated into a paper product, such as a bank note, as a counterfeit protection device.

Paper products in accordance with the present invention are made by mixing slurry paper pulp with the planchettes described above. The planchettes form a hydrogen bond with the cellulose fibres in the paper pulp and when the pulp is formed into a continuous web of paper, the planchettes in the pulp become an integral part of the web or sheet of paper. The coloured stripes or regions of the planchettes can only

be seen under ultra-violet light, thereby providing a security feature that cannot be seen in normal light conditions.

In one form of the invention, the planchettes are made from a material with a different density and structure to the base paper with which it is to be used. This allows the planchette to be seen in the so-called "look through" of the paper. The effect is similar to viewing a watermark.

The maple leaf shown in Figure 1 is, of course, only one of many possible shapes for a planchette in accordance with the present invention. For example, there are many other national symbols that could be chosen, such as a fern for New Zealand.

The present invention is not limited to planchettes having the shape of a national symbol. Indeed, there is an unlimited variety of shapes that could be used.

Figures 2 to 4 show three exemplary planchettes in accordance with embodiments of the present invention. Figure 2 shows a heart-shaped planchette 2′, having stripes 4′, 6′ and 8′ similar to the striped regions 4, 6 and 8 of the planchette 2. Figure 3 shows a star-shaped planchette 2′′, having stripes 4′′, 6′′ and 8′′ similar to the striped regions 4, 6 and 8 of the planchette 2. Figure 4 shows a planchette 2′′′ having an abstract shape and having stripes 4′′′, 6′′′ and 8′′′ similar to the striped regions 4, 6 and 8 of the planchette 2.

The planchettes of the embodiments of the invention described above are manufactured from tissue or thin paper without optical brighteners. The optimum paper is a high porosity,

high wet strength tissue paper with a nominal basis weight of 25 grams per square metre. The substance of the paper is significant since the ability to print and cut a thin material provides a technical barrier to duplicating the planchettes.

Planchettes in accordance with the present invention could be manufactured using paper having the properties listed below. These properties have been developed with the intention of providing a planchette that works well but are only one example. Other papers could be used.

Properties	**Units**	**Minimum**	**Maximum**	**Average**
Substance	g/m^2	15	45	24.8
Lemm capillary climb md	mm	16	17	16.6
Wet tensile strength	N/15mm	4.5	5.9	5.14
Bulk	Cm^3/g	2.4	2.5	2.46
High porosity	$1/mn/100cm^2$	24	31.2	27.9
Humidity	%	4.9	7.0	4.98
pH of aqueous extract				6.8

In addition, the target Bensten porosity (defined by ISO standard 5636/3) is 1500 ml/mm, the minimum Bensten value is 700 ml/mm.

Before the planchettes of the present invention are mixed with the paper, the planchettes are coated with a varnish. The varnish protects the print against abrasion and also improves the affinity of the planchettes in the finished paper. In one embodiment, the varnish used is a 4% solution

of Solvitose NX in acrylic water based binder that is applied to both sides of the printed material.

The planchettes 2, 2′, 2′′ and 2′′′ offer a number of advantages when incorporated into a paper product as an anti-counterfeiting feature. First, the planchettes are small and have intricate shapes. Second, in use, the coloured regions of the planchettes define the planchettes as they are viewed. The precision of this effect is created by punching the planchettes from a larger piece of paper and is extremely difficult to recreate by printing alone. Third, the features are invisible in reflected light but become visible in transmitted light.

Each of these features provides an anti-counterfeiting arrangement that is difficult to recreate by printing or copying. Together, they provide a very secure anti-counterfeiting product.

In the embodiments of the invention described above, the print is applied to both sides of the planchette. This is advantageous since, in this finished paper product, the orientation of each individual planchette is unknown. If both sides of the planchette include the print, this will be visible regardless of the orientation of the planchette. Alternatively, a similar effect can be achieved by printing on one side of the planchette in such a way that the print is visible on both sides of the planchettes. This effect can be easily achieved, for example, by using sufficiently thin paper.

The printed stripes or regions abut one another and do not overlap. Further, the pigments are selected so that there is

no migration of colours into one another and no leeching or migration of the pigments into the surrounding paper.

In the embodiments of the invention described above, printed regions are provided on a paper substrate or some other material that is compatible with a paper or other substrate. This is not an essential feature of the invention. Figure 5 shows a cross-section of a planchette, indicated generally by the reference numeral 10, in accordance with an alternative form of the invention. The planchette 10 is a multi-layered material comprising an outer later 12 and an inner layer 14. The outer layer 12 is made from paper or some other material compatible with papermaking, whilst the inner layer 14 is made of an opaque material so that in transmitted light, the planchette appears as a type of watermark in the base paper or other substrate. The opaque layer can be generated by selectively de-metallising or metal foiling a specific design. This can be very intricate in itself and then the piece itself is cut or punched to a different shape which encompasses this design.

In an alternative form of the invention, the outer layer 12 of the planchette 10 is omitted. In such an arrangement, the opaque material will need to be compatible with the papermaking process such that the material forms part of the final paper product.

As described above, the planchettes in accordance with the invention may be formed by stamping and cutting. This is not essential. Figure 6 shows a planchette 20 that is formed on a substrate 22. As shown in Figure 6, striped regions 24, 26 and 28 are formed on the substrate 22 in order to form a maple leaf figure. The regions 24, 26 and 28 may be formed from different coloured foils, different coloured print with

tonal variations or optical effects such as iridescence which can be viewed in transmitted light. The resultant combination of opaque and semi transparent regions or printed regions forms the complex shape. As shown in Figure 6, the substrate 22 has a simple form (a square in this example). The substrate 22 may be transparent so that the when the planchette 20 is incorporated into a paper product, the substrate 22 is not visible such that only the complex shape generated by the regions 24, 26 and 28 is visible. Furthermore, in some embodiments of the invention, the regions 24, 26 and 28 are visible in transmitted light but not in reflected light. Further, a "window" may be punched from the paper or other substrate in the form of an intricate shape, such as the shape shown in Figure 6. In effect, this "reversed out" shape gives a "negative" watermark with the surrounding regions visible in the "look through" and the inner region transparent. Another version of this embodiment comprises the punched out window which is then laminated with an optical film which can be iridescent, pearlescent or holographic such that an interesting effect is produced in transmitted light, which effect is difficult to counterfeit.

Many of the exemplary embodiments described above include three diagonal striped regions. This is not an essential feature of the invention. There are many variants to this arrangement. For example, more or fewer regions could be provided; indeed, in some embodiments of the invention, only one region is provided. Further, the regions may have different shapes and/or different orientations to those shown.

In many embodiments of the invention, the planchettes incorporated into paper products are not visible in ordinary light conditions. Thus, the normal appearance of the paper

product is not affected by the incorporation of the planchettes into the paper. In one exemplary arrangement, the planchettes are visible in transmitted light, but are not visible in reflected light. In a variant of the invention, the coloured regions of the planchette are visible in lighting conditions other than ultra-violet light, for example, the coloured regions may be visible in all light conditions and in some forms of this variant, the coloured regions are visible in both transmitted and reflected light.

In addition to being difficult to replicate, the optical effect is striking and relatively easy to describe to the general public.

Claims:

1. A planchette for inclusion in a paper product, the planchette comprising one or more regions, wherein said regions are coloured and the colours are visible only under ultra-violet light, and wherein said planchette has a complex shape.

2. A planchette for inclusion in a paper product, the planchette comprising one or more regions, wherein said regions are coloured and the colours are visible only under ultra-violet light, and wherein said planchette has a shape having one or more indentations, projections and/or lobes.

3. A planchette for inclusion in a paper product, the planchette comprising one or more regions, wherein said regions are coloured and the colours are visible only under ultra-violet light, and wherein said planchette has the shape of a multi-sided symbol.

4. A planchette as claimed in any preceding claim, wherein said planchette comprises a plurality of regions.

5. A planchette as claimed in claim 4, wherein said regions are striped regions.

6. A planchette as claimed in claim 4 or claim 5, wherein said colours include a plurality of different colours.

7. A planchette as claimed in claim 6, wherein the regions abut one another with no overlap of colour at the boundaries of the regions.

8. A planchette as claimed in any preceding claim, wherein said one or more regions are formed from coloured foils.

9. A planchette as claimed in any preceding claim, wherein said one or more regions are formed by printing.

10. A planchette as claimed in any preceding claim, wherein said regions are coloured printed regions having tonal variations.

11. A planchette as claimed in any preceding claim, wherein said one or more regions comprise one or more of a thermochromic coating, a photochromic coating, a magnetic coating and an infra-red coating.

12. A planchette as claimed in any preceding claim, wherein said shape is formed by cutting or stamping.

13. A planchette as claimed in any one of claims 1 to 11, wherein said one or more regions are formed by printing or foiling onto a transparent substrate.

14. A planchette as claimed in any preceding claim, wherein said planchette has a different density to the paper into which it is intended to be incorporated.

15. A planchette as claimed in any preceding claim, wherein said planchette is invisible in reflected light, but visible in transmitted light.

16. A planchette as claimed in any preceding claim, wherein said planchette is invisible in reflected light, but visible in ultra-violet light.

17. A planchette as claimed in any preceding claim, wherein said planchette comprises a plurality of layers, wherein at least one layer is made from a material compatible with papermaking and at least one layer is made of an opaque material.

18. A method of manufacturing planchettes, the method comprising the steps of forming one or more regions on a substrate, wherein said regions are coloured and the colours are visible only under ultra-violet light, the method further comprising the step of forming the substrate into a plurality of planchettes, each having a complex shape.

19. A method of manufacturing planchettes, the method comprising the steps of forming one or more regions on a substrate, wherein said regions are coloured and the colours are visible only under ultra-violet light, the method further comprising the step of forming the substrate into a plurality of planchettes, each having one or more indentations, protections and/or lobes.

20. A method of manufacturing planchettes, the method comprising the steps of forming one or more regions on a substrate, wherein said regions are coloured and the colours are visible only under ultra-violet light, the method further comprising the step of forming the substrate into a plurality of planchettes, each planchette being a multi-sided symbol.

21. A method of manufacturing planchettes as claimed in any one of claims 18 to 20, wherein said step of forming the substrate into a plurality of planchettes comprises punching said substrate.

22. A method as claimed in any one of claims 18 to 21, wherein said regions are formed from coloured foils.

23. A method as claimed in any one of claims 18 to 22, wherein said regions are formed by printing.

24. A method as claimed in claim 23, wherein said step of printing one or more regions on a substrate comprises printing a repeating pattern of regions on said substrate.

25. A method of manufacturing one or more planchettes, the method comprising the steps of forming a plurality of coloured regions on a substrate from coloured foils or coloured print, wherein the or each planchette has one or more of the following characteristics: a complex shape; one or more indentations, projections and/or lobes; and a multi-side symbol.

26. A method of manufacturing a paper product, the method comprising the steps of:

mixing one or more planchettes as claimed in any one of claims 1 to 17 or one or more planchettes manufactured using the method of any one of claims 18 to 25 with slurry paper pulp; and

forming the paper pulp and planchette mix into a continuous web of paper.

27. A paper product containing a plurality of planchettes as claimed in any one of claims 1 to 17 or manufactured using the method of any one of claims 18 to 25.

28. A paper product as claimed in claim 27, wherein said paper product is a bank note.

29. A paper product as claimed in claim 27 or claim 28, wherein said planchettes are formed from paper having a different density to the paper of said paper product.

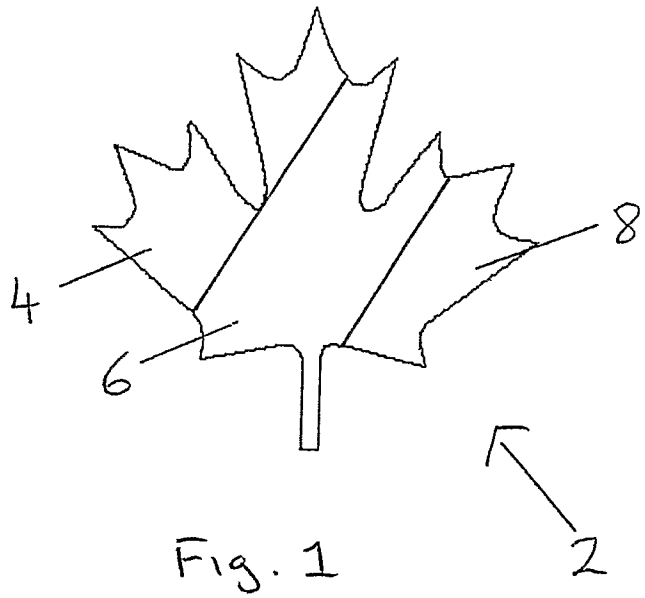

Fig. 1

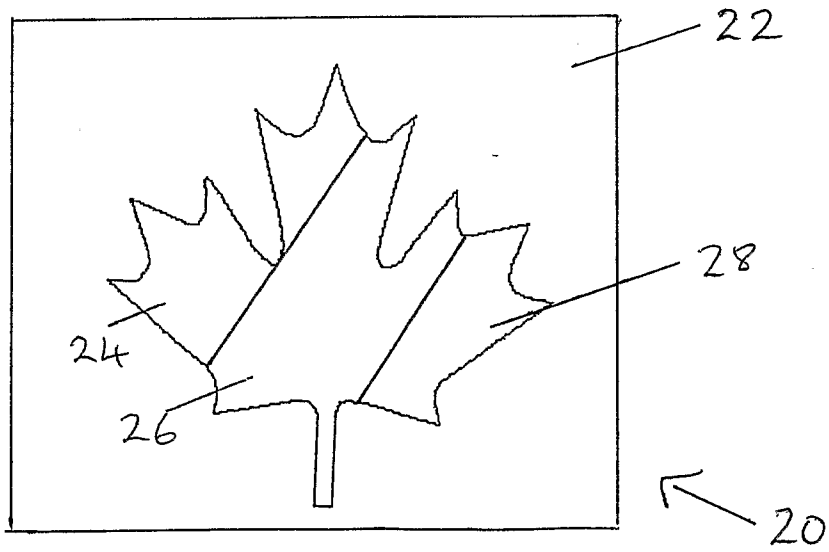

Fig. 6

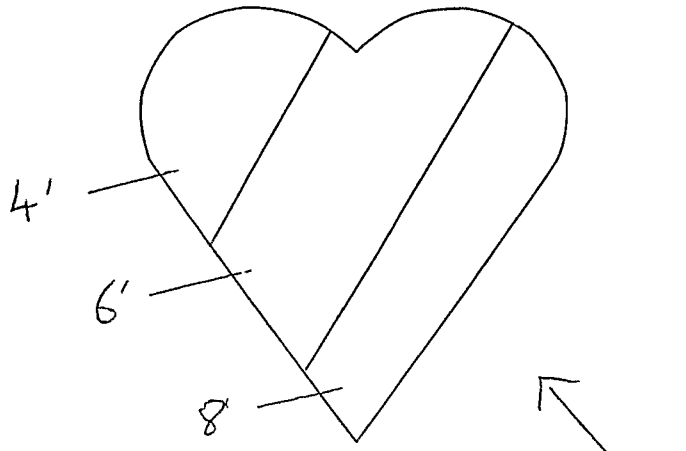

Fig. 2

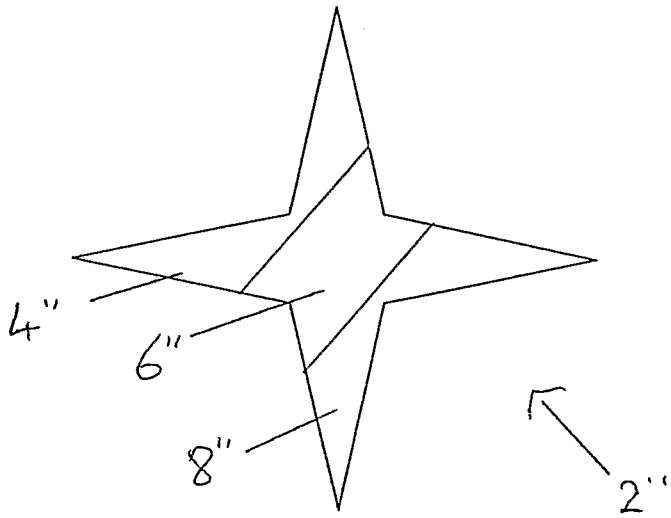

Fig. 3

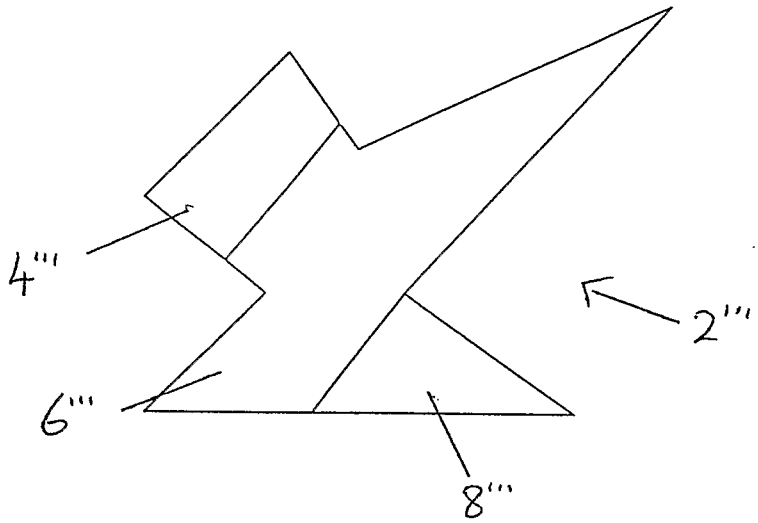

Fig. 4

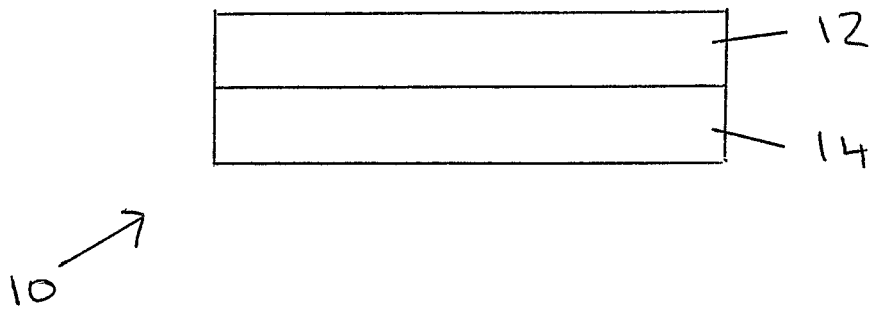

Fig. 5