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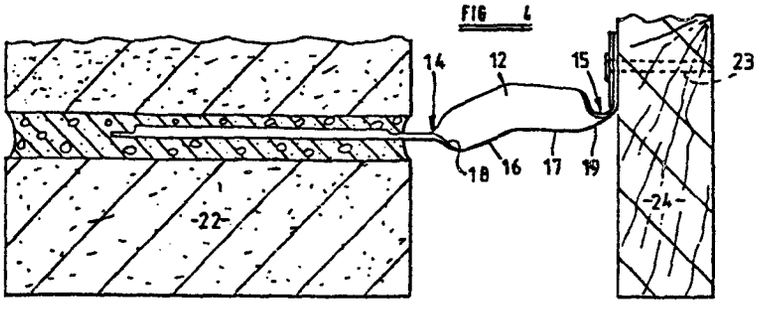
(54) Timber frame cavity wall tie and method and blank for making the tie.

(57) A timber frame cavity wall tie (10), (40), comprises a strip of metal having two twists (14), (15); (44), (45). The outer leaf first portion (11), (41), of the tie has mortar keying formations and lies in a generally horizontal plane in use. The adjacent cavity bridging portion (12), (42), lies upright and has one or more water shedding formations (16), (49), within the cavity. The third inner portion of the tie (13), (43), is stiffened by a rib (21), (52), and secured to the inner timber frame leaf of a cavity wall. Immediately adjacent the stiffened portion (21), (52), there is an unstiffened portion (15), (46), which may be weakened by notches (54), at which the frame tie can bend to take up movement of the inner timber frame leaf of the cavity wall. The cavity bridging second part (12), (42), can have either an upwardly extending arched profile (12), with two water shedding formations or a downwardly directed U or V shaped profile having a single drip formation (49), in each case the water shedding properties being retained even after movement of the timber frame inner leaf.

FIG 4



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TITLE: TIMBER FRAME CAVITY WALL TIE AND METHOD AND BLANK FOR MAKING THE TIE

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This invention relates to a cavity wall tie for use in timber frame building construction, to secure a masonry outer leaf to a timber frame inner leaf of a timber frame cavity wall.

In conventional cavity walls where the outer and inner skins are of bricks or blocks, there is little or no relative movement between the inner and outer leaves of the wall after construction. In timber frame construction, the inner timber frame leaf tends to shrink relative to the outer masonry wall and this means that frame ties installed before shrinkage may not function satisfactorily after the building has been constructed for some time.

A wall tie for a cavity wall is necessary to link the inner and outer leaves of the wall, and should withstand both tensile forces tending to pull the leaves apart, and compressive forces tending to push them together. It should also have some means for shedding water which may seep into the cavity and which must not be allowed to penetrate the inner leaf. Finally, since mortar used to bond the outer masonry may fall into the cavity onto ties below the working level, it is desirable that the tie should not afford a surface on which the mortar can settle, bridging the cavity and encouraging water penetration.

While these features can be provided in a wall tie for use with masonry inner and outer leaves, it is more difficult to achieve a solution for timber frame use.

Since the frame tie will need to move with the relative movement of the inner and outer leaves of the wall, it may lose compressive strength, or may start to allow water penetration into the inner leaf, for example.

It is an object of the present invention to provide a timber frame tie for use in timber frame cavity walls, which is capable of retaining its usefulness even after shrinkage of the timber frame inner leaf relative to the outer masonry leaf.

According to this aspect, the invention provides a timber frame cavity wall tie comprising an elongate strip of rigid, elastically deformable material such as metal, having:-

a first part adapted to be embedded in a joint of a masonry outer leaf of the wall;

a cavity-bridging second part;

and a third part adapted to be secured upright to a face of a timber frame inner leaf of the wall in use;

the cavity-bridging second part having a respective twist adjacent each of the first and third parts so as to lie primarily in an upright plane in use, and having in its lower edge at least one water drip formation;

and at least the third part of the tie having stiffening means to resist deformation and the cavity bridging second part having an unstiffened region between the third part and the adjacent twist.

The first part of the tie may also be stiffened and the cavity bridging part may have a second unstiffened region between the first part and its adjacent twist.

Said unstiffened region or regions may be weakened to permit the tie to bend or deflect more readily. For example, edges of the strip may be cut away to narrow the strip at said unstiffened region or regions.

The drip formation may be provided by the intersection of two relatively angled portions of the lower edge of the strip.

The strip may be of U or V shape or arched (that is of inverted U or V shape) in side elevation at the second cavity bridging part.

The first part may have mortar keying formations such as ribs, grooves, notches or apertures.

The tie may be made of stainless steel, of galvanised mild steel or of other corrosion resistant metal.

The invention also has an object of providing a method of manufacturing the tie set out above which is capable of high speed operation.

According to this aspect, the invention provides a method of making the tie as set out above, the method comprising feeding to a press a parallel sided strip of method of approximately the intended width of the tie and performing a series of operations on the strip including the step of performing a pressing operation laterally in the plane of the strip on a portion of the strip while constraining the adjacent portions, so as to form a U or V shaped profile.

The method may also include a subsequent step of twisting the strip.

The invention also provides a blank for making a tie as set out above, the blank comprising first and third

end portions having parallel central axes and a second part of U or V shaped profile linking the first and third parts.

The V or U shaped second part may have limbs of unequal width and the first and third end portions may be non-aligned.

The third and optionally the first part of the blank may have cut away edge regions adjacent the junction with the second part of the blank.

The first part of the blank may have further cut away edge portions towards its free end.

Frame ties embodying the invention will now be described in more detail by way of example only with reference to the accompanying drawings, in which:-

FIGURE 1 is a side elevational view of a frame tie;

FIGURE 2 is a plan view of the tie of Figure 1;

FIGURE 3 is an end elevational view of the tie;

FIGURE 4 is a side elevational view of the tie in use in a timber frame cavity wall immediately after construction;

FIGURE 5 is a similar view to Figure 4, showing the tie in use after shrinkage of the inner leaf;

FIGURE 6 is a detail of an alternative form of mortar key for the tie.

FIGURE 7 is a side elevational view of a modified frame tie.

FIGURE 8 is a plan view of the modified frame tie.

FIGURE 9 is an end elevational view of modified tie on the arrow 9 of Figure 7.

FIGURE 10 illustrates a blank for making the tie of Figures 7-9.

FIGURE 11 is an end elevational view of a further modified tie.

FIGURE 12 is a view similar to that of Figure 10 of the blank for making the tie of Figure 11.

FIGURE 13 shows the modified tie of Figures 7-9 in use in a timber frame cavity wall immediately after construction.

FIGURE 14 is a view similar to Figure 5 showing the modified tie of Figures 7-9 in use after shrinkage of the inner timber frame leaf.

Referring to Figures 1 to 3 of the drawings, there is shown a frame tie 10 comprising three parts formed integrally from a single strip of metal such as stainless or galvanised mild steel.

The first part 11 is disposed in use in a masonry outer leaf of a cavity wall, and lies horizontally in a mortar coursing joint of the masonry. The second, cavity bridging part 12 is disposed primarily in a vertical plane in use. The third part 13 of the tie is secured in a generally vertical plane at right angles to the plane of part 12, to a face of the inner timber frame leaf of the wall in use.

The tie 10 is formed with two twists, the first twist 14 being between the first and second parts 11 and

12, while the second twist 15 is between the second and third parts 12 and 13. Adjacent the second twist 15 there is additionally a bend in the tie, so that the third part 13 can extend upwardly in a vertical plane.

The cavity-bridging second part of the tie 12 is of an arched profile. In the example illustrated, this part 12 is of inverted V shape, but it could be of another arched shape, such as inverted U shape.

The arch defines a pair of oppositely inclined lower edges 16 and 17 which merge with the twists 14 and 15 respectively. The included angle between these edges 16 and 17 is about 150° in the example shown, but could be within a range of about 20° either way.

The twist 14 is formed with one edge 18 of the metal of the strip being deflected downwardly from the general plane of the first part of the strip, to merge with the lower edge 16 of the second portion. The edge 16 then extends upwardly towards its junction with the other lower edge 17 of the second portion.

Similarly, the metal strip has a downwardly deflected edge 19 at the second twist 15, which merges with the edge 17.

In addition, a drainage hole 20 is provided in a generally horizontal portion of the twist 15.

The upright third part of the tie 13 has a stiffening formation such as a rib 21, which extends to the foot of the part 13, at the start of the twist.

The tie is shown in use in Figures 4 and 5 of the drawings. In Figure 4, it is shown immediately after construction of a timber frame cavity wall, with the first part of the tie 11 embedded in the mortar of a

coursing joint of the outer leaf 22. The cavity bridging second part is tilted generally upwardly, with the lower edge 16 making a greater angle to the horizontal than the lower edge 17. The third part is nailed at 23 to the inner timber frame leaf 24 of the wall.

The tie is not pre-stressed when it is built into the wall. It is strong both in tension and in compression, relying on the strength of the metal. Any moisture in the cavity will tend to trickle off the tie, which presents a narrow edge upwardly into the cavity, without any moisture trapping horizontal parts. In the event that moisture might run into the region of the twist 15 below the third part 13 of the tie, the drainage hole 20 will ensure that it is not retained. Moisture will run down to the lower edges 16 and 17 and drip off from the lowest point of the tie, at the junction of the edge 16 and the twist edge 18.

After some time has passed, the inner timber frame leaf of the wall will tend to shrink and will settle downwardly relative to the outer masonry leaf, which has more dimensional stability. It is necessary, for a two storey dwelling, to allow for a relative vertical movement of up to 12 mm to take place between the two leaves.

Figure 5 shows the condition of the tie when this movement has taken place. It will be seen that the tie has flexed at the position between the stiffening formation 21 and the cavity-bridging second part 12 of the tie. The rib is required to prevent flexure taking place in the third part of the tie, which might tend to pull its lower end away from the inner leaf. The tie will bend at the point where the resistance to bending about a horizontal transverse line is the least, that is, at the horizontally disposed central region of the twist. The metal of the cavity-bridging second part of the tie has maximum resistance to bending in this sense, since such

bending would be in the plane of the metal.

Some flexure may also take place at the twist 14 adjacent the outer leaf, where again the resistance to bending is least in the horzontal central region of the twist.

After movement of the tie has taken place, it will be seen in Figure 5 that the lower edge 17 is now inclined downwardly away from the horizontal at a greater angle than the edge 16. The lowest point of the tie is now at the junction of the edge 17 with the adjacent twist edge 19. Thus any water in the cavity will tend to drip off the tie at this position, still somewhat spaced from the inner leaf.

The tie will retain its strength in both compression and in tension as before and compressive stresses undergone during movement will have been released by the slight flexure of the tie referred to.

The form of mortar key shown in Figures 1 and 2 on the first part 11 of the frame tie comprises a series of regularly spaced chevron shaped corrugations 25 in the metal of the tie. The free end 26 of the first part 11 has rounded corners, to reduce the risk of injury to a bricklayer from projecting sharp corners.

In Figure 6 there is shown an alternative form of mortar key. The tie has notches 27 formed in its edges alternating from side to side along the tie. Each notch 27 has a transverse edge 28 and a an inclined edge 29, arranged to resist pulling out of the tie from the mortar bed in which it is seated in use. The tie also has transverse corrugations 30 and holes 31, into which mortar can penetrate and set to secure the tie firmly to the outer masonry leaf 22 of the wall in use. The holes 31 may have raised borders for extra keying.

The tie described can be manufactured by blanking and pressing operations. For high speed manufacture in a press, it is envisaged that a strip of metal of the intended final width of the tie would be fed longitudinally into the press and would have a series of pressing and forming operations performed on it. The arched profile of the second part of the tie could be provided by restraining the portions of the strip adjacent the position at which the arch is to be formed, and applying lateral force in the plane of the strip to distort the metal into an arched profile. The strip would simultaneously be prevented from buckling or twisting at the position of the arch. Any wrinkling of the metal would be straightened by the stretching of the metal during the subsequent step of forming the twists.

Referring to Figures 7 to 9 of the drawings, there is shown a frame tie generally indicated at 40, again comprising three parts formed integrally from a single strip of metal which is rigid and elastically deformable, for example stainless or galvanised mild steel.

The frame tie 40 comprises a first part 41 which is disposed in use in a masonry outer leaf of a cavity wall and lies horizontally in a mortar coursing joint of the masonry. The second, cavity bridging part 42 is disposed primarily in a vertical plane in use. The third part 43 of the tie is secured in a generally upright vertical plane at right angles to the plane of the second part 42, to a face of the inner timber frame leaf of the wall in use.

The tie 40 is formed with two twists, the first twist 44 being between the first and second parts 41 and 42, while the second twist 45 is between the second and third parts 42 and 43. Adjacent the second twist 45,

there is additionally a pre-formed bend 46 in the tie so that the third part 43 can extend upwardly in a vertical plane.

The cavity bridging second part of the tie 42 has a profile which includes a pair of relatively angled edge portions at its lower edge, these being shown at 47 and 48. The edge portions meet at a sharp or rounded obtusely angled point 49 which provides a drip formation from which water which may collect in the cavity of the wall in use may drip off the tie. It will be noted that the drip formation 49 is at the lowest point of the tie and that this prevents any moisture condensing in the cavity from running inwardly towards the timber frame inner leaf.

The lower edge 47 merges with the first twist 44 and the lower edge 48 merges with the second twist 45. The edges 47 and 48 meet at an angle of about 130° in the example shown but this angle could be varied within a range of about 20° either way.

It will be seen that the bend 46 at the foot of the third part 43 of the tie is at a higher level than the general plane of the first part of 41 of the tie. This is the initial condition of the tie as manufactured and as secured in place in a wall. However, the tie is designed to accommodate considerable movement of the inner leaf of the wall for reasons already described.

Both the first part 41 and the third part 43 of the tie have stiffening means adjacent, but slightly spaced from, the neighbouring twists 44 and 45.

The first part 41 of the tie, in addition to the chevron type pressed mortar keying formations 50, has a U shaped rib 51 pressed upwardly into its surface as best seen in Figure 8 of the drawings. Optional edge cut outs

67 may improve mortar keying.

The third part 43 of the tie has a broad flattened rib 52 running throughout its length down to the preformed bend 46. In use, both the first and third parts are therefore rigidified.

Between these rigidified parts and the twists 44 and 45, there are relatively weakened parts of the tie. It will be seen particularly from Figure 8 of the drawings that cut outs 53, 54 are provided in the side edges of the tie to reduce the width of the metal and hence reduce the resistance to bending at two bend regions between the stiffening formations 51, 52 and the adjacent twists 44, 45.

However these cut outs are optional and their size and shape may be varied to provide the desired stiffness and flexibility characteristics.

Referring to Figures 5 and 6 of the drawings, the reason for the weakened bend portions will be outlined.

Figure 13 shows the tie 40 in use in a cavity wall comprising a brick or block work outer masonry leaf 55 and a timber frame inner leaf 56. The first part 41 of the tie is embedded in a mortar coursing joint 57 of the outer leaf 55 and it will be seen that the mortar keying formations 50 on the first portion of the tie tend to widen in a direction away from the wall cavity 58 which lies between the inner and outer skins.

The third part 43 of the tie is secured by a single nail 59 to the timber frame inner leaf 56. The nail is preferably of stainless steel and has annular rings on its shank, to increase its resistance to withdrawal from the timber.

In Figure 13 of the drawings, it will be seen that the pre-formed bend 46 at the foot of the third part 43 of the tie lies at a level which is somewhat higher than the general plane of the first part 41 of the tie. The tie is not pre-stressed when it is built into the wall. It is strong in both tension and compression, relying on the strength of the metal.

After some time has passed, the inner timber frame leaf 56 of the wall will tend to shrink and will settle downwardly relative to the outer masonry leaf 55, which has more dimensional stability. It is necessary, for a two storey dwelling, to allow for a relative vertical movement of up to 12 mm to take place between the two leaves.

Figure 14 of the drawings shows the condition of the tie when this movement has taken place. It will be seen that the tie has flexed at the weakened, unstiffened region of the cut outs 54, while the stiffened third part of the tie 43 remains firmly against the timber frame to ensure that there is no tendency for the nail 59 to pull out.

Some flexure has also occurred adjacent the outer leaf at the weakened, unstiffened region of the cut outs 53.

In comparing Figures 5 and 6, it will be seen that the level of the pre-formed bend 46 has now dropped below the general level of the first part 41 of the tie. However, it will be seen that the cavity bridging part of the tie has not buckled or distorted between the two twists 44 and 45, but remains the same shape. The drip formation 49 still forms the lowermost point of the tie and will continue to operate to shed any moisture which may collect on the tie within the cavity. The adjoining edges 47 and 48 of the cavity bridging second part of the

tie have changed their orientation but still both lead downwardly to the drip formation 49.

Throughout the movement of the tie, it remains strong in both tension and compression, and the fixing to the timber frame remains secure because of the stiffening rib 52 of the third part of the tie. The only change to the tie is a small controlled elastic deformation at the pre-selected bend regions.

It will be seen that, because the central cavity bridging second part of the tie 42 is disposed principally in an upright plane, not only does it shed moisture very readily but it also provides no support for wet mortar. Thus, any mortar which falls from the outer leaf masonry at higher levels cannot readily lodge on the tie to provide a moisture bridge between the outer and inner skins of the cavity wall.

Figure 10 of the drawings shows a first embodiment of blank from which the tie 40 is manufactured. The blank 60 will be seen to have a first part 61, corresponding to the first part 41 of the tie, a generally V shaped second part 62 corresponding to the cavity bridging part 42 of the tie, and a third part 63 corresponding to the upright third part of the tie. The angled second part 62 has the edges 47, 48 which meet at the drip formation point 49. On the opposite side of the blank, there are two equivalent angled edges 64 and 65 which are provided purely for manufacturing reasons, so that a series of strips can be stamped from a larger sheet of metal with minimum wastage.

Suitable cut outs 53 and 54 are provided to define the weakened regions and a hole 66 is punched in the third portion of the blank to accommodate the fixing nail 59 shown in Figures 5 and 6.

It will be seen that the first and third parts 61 and 63 of the blank are not aligned with each other although they have parallel axes. The reason for this offset is that the twists 44 and 45 are formed in the portions of the blanks 44', 45' which are between the dotted lines shown in Figure 4. The region 44' lies within the generally V shaped central region of the blank whereas the twist region 45' lies in a part of the tie which is aligned with the third part of the tie. If no offset were provided, the twisting of the tie in manufacture would produce an offset between the axes of the two end portions of the tie. By offsetting the axes of these end portions in the blank, the offset caused by the twisting operation is reduced although a slight offset, typically 0.54 mm, is allowed for in the finished product.

Figure 12 shows a blank for making a slightly further modification of the tie. In this case, the axes of the first and third parts 71 and 73 of the blank are aligned and the vee shaped formation of the second part 72 of the blank is symmetrical.

Additional edge cut outs 67 may be provided on the first part 71 of the blank to assist in mortar keying.

Figure 11 of the drawings shows the tie formed from the blank of Figure 12, from which it can be seen that the plane of the upright cavity bridging part is slightly off-set from the axial central plane of the first and third end portions of the tie.

CLAIMS

1. A timber frame cavity wall tie comprising an elongate strip of rigid, elastically deformable material such as metal, having:-

a first part adapted to be embedded in a joint of a masonry outer leaf of the wall;

a cavity bridging second part;

and a third part adapted to be secured upright to a face of a timber frame inner leaf of the wall in use;

characterised in that the cavity bridging second part (12; 42) has a respective twist (14, 15; 44, 45) adjacent each of the first (11; 41) and third (13; 43) parts so as to lie primarily in an upright plane in use, and having in its lower edge at least one water drip formation (16, 17; 49);

and in that at least the third part (13; 43) of the tie (10, 40) has stiffening means (21; 52) to resist deformation and the cavity bridging second part has an unstiffened region (53) between the third part (13; 43) and the adjacent twist (15; 45).

2. A timber frame cavity wall tie according to Claim 1 further characterised in that the first part (11; 41) of the tie (10; 40) is also stiffened and the cavity bridging part (12; 42) has a second unstiffened region (53) between the first part (11; 41) and its adjacent twist (14; 44).

3. A timber frame cavity wall tie according to Claim 1 or Claim 2 further characterised in that the unstiffened region or regions are weakened (53, 54) to permit the tie to bend or deflect more readily.

4. A timber frame cavity wall tie according to Claim 3 further characterised in that the edges of the strip are cut away to narrow the strip to provide said weakening

(53, 54) at the unstiffened region or regions.

5. A timber frame cavity wall tie according to any preceding claim further characterised in that the drip formation is provided by the intersection of two relatively angled portions (16, 18; 17, 19; 47, 48) of the lower edge of the strip.

6. A timber frame cavity wall tie according to any preceding claim further characterised in that the strip is of U or V shape in side elevation at the second, cavity bridging part (42).

7. A timber frame cavity wall tie according to any one of claims 1 to 5 further characterised in that the strip is of arched, inverted U or V shape in side elevation at the second, cavity bridging part (12).

8. A method of making a timber frame cavity wall tie, characterised in that the method comprises feeding to a press a parallel sided strip of metal of approximately the intended width of the tie and performing a series of operations on the strip including the step of performing a pressing operation laterally in the plane of the strip on a portion of the strip while constraining the adjacent portions, so as to form a U or V shaped profile.

9. A method according to Claim 8 further characterised in comprising the subsequent step of twisting the strip.

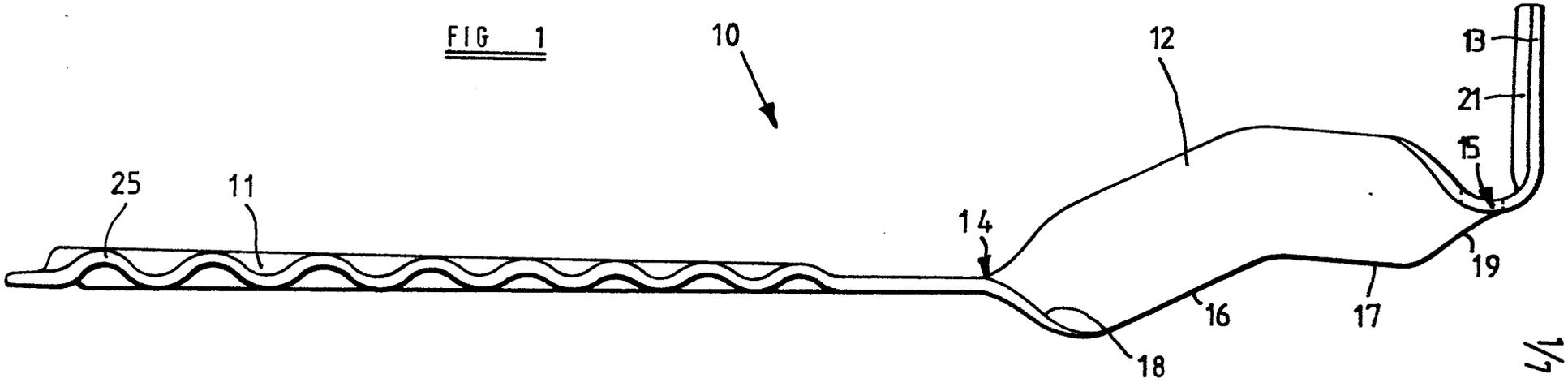
10. A blank for making a timber frame cavity wall tie, characterised in that it comprises first (61) and third (63) end portions having parallel central axes and a second part (62) of U or V shaped profile linking the first and third parts.

11. A blank according to Claim 11 further characterised in that the U or V shaped second part (62) has limbs of

unequal width and the first and third end portions are non-aligned.

12. A blank according to Claim 10 or Claim 11 further characterised in that the third and optionally the first part of the blank have cut away edge regions adjacent the junction with the second part of the blank.

FIG 1



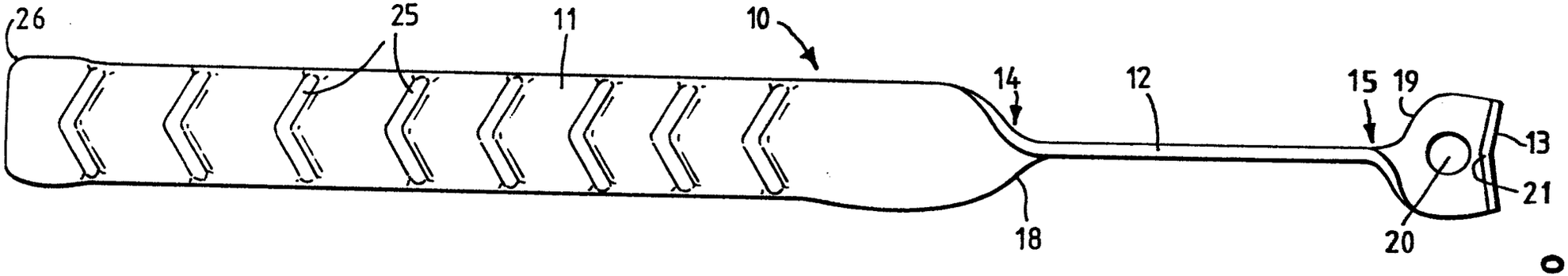


FIG 2

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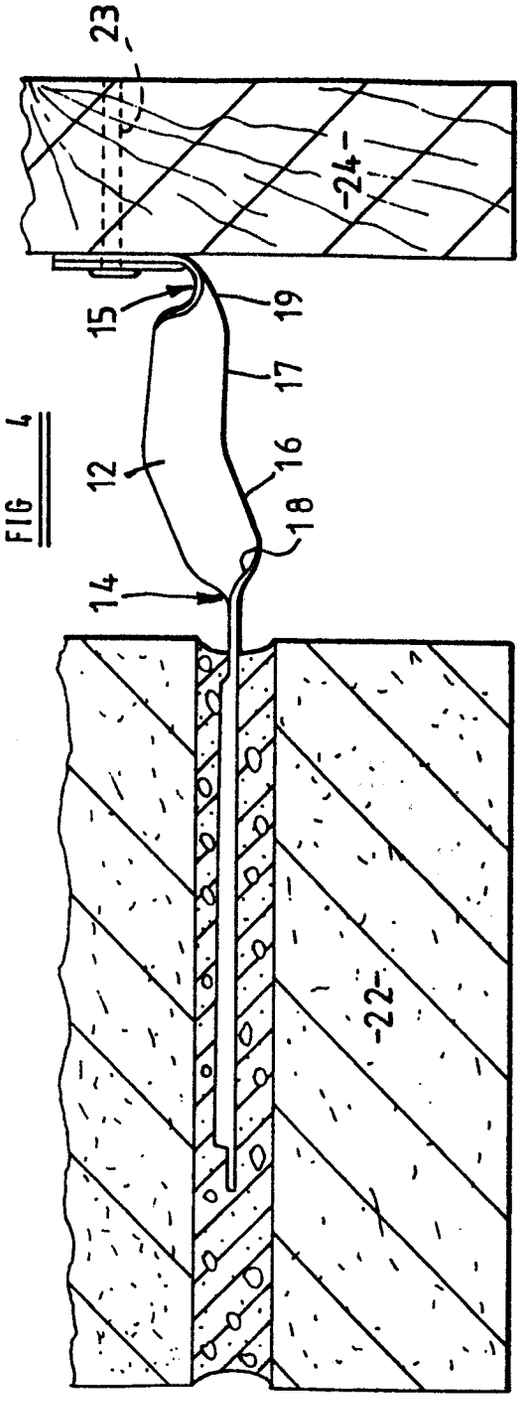


FIG 4

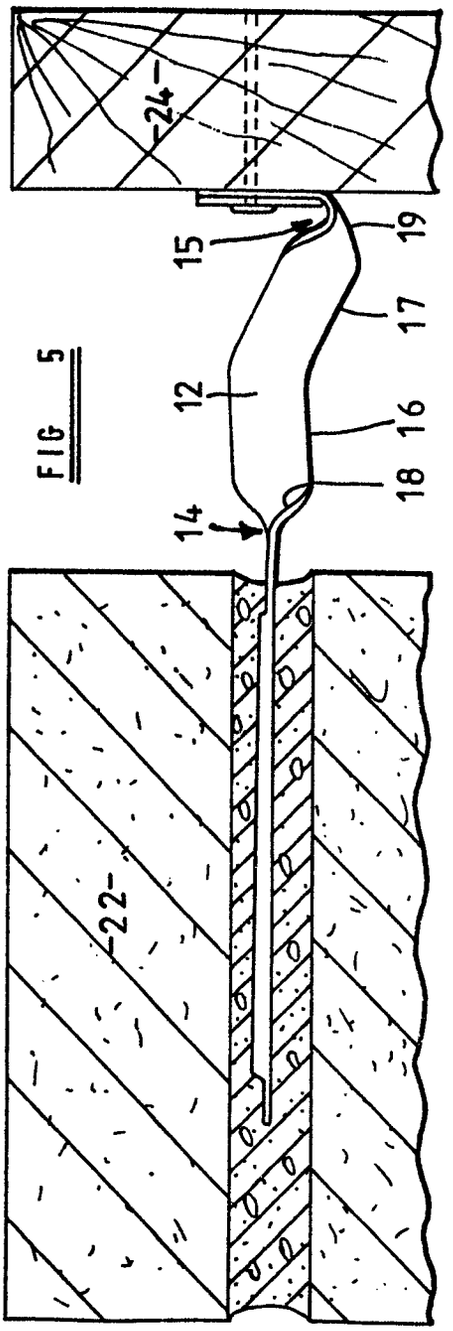
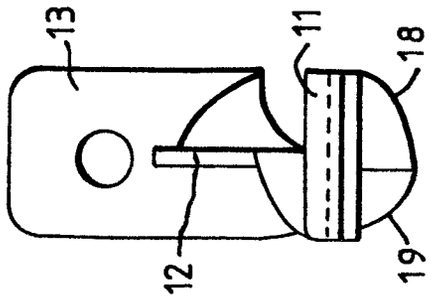


FIG 5



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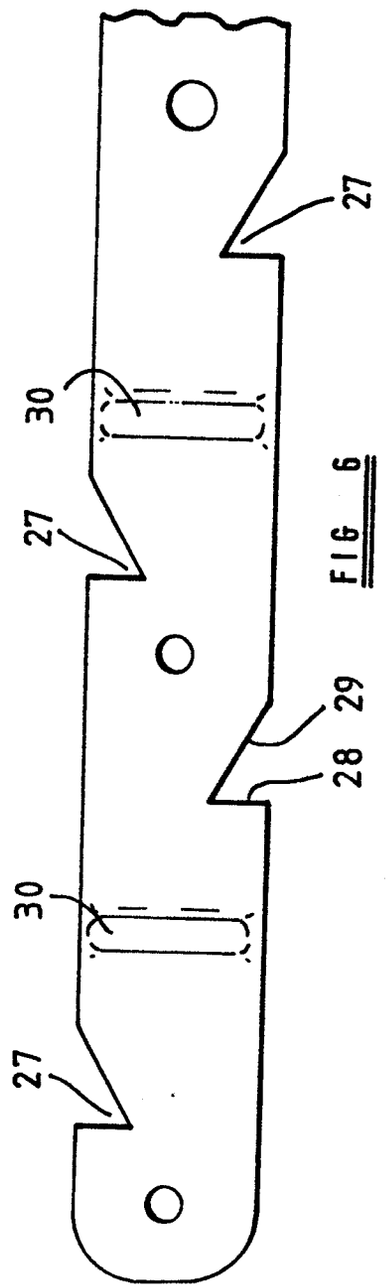

FIG 6

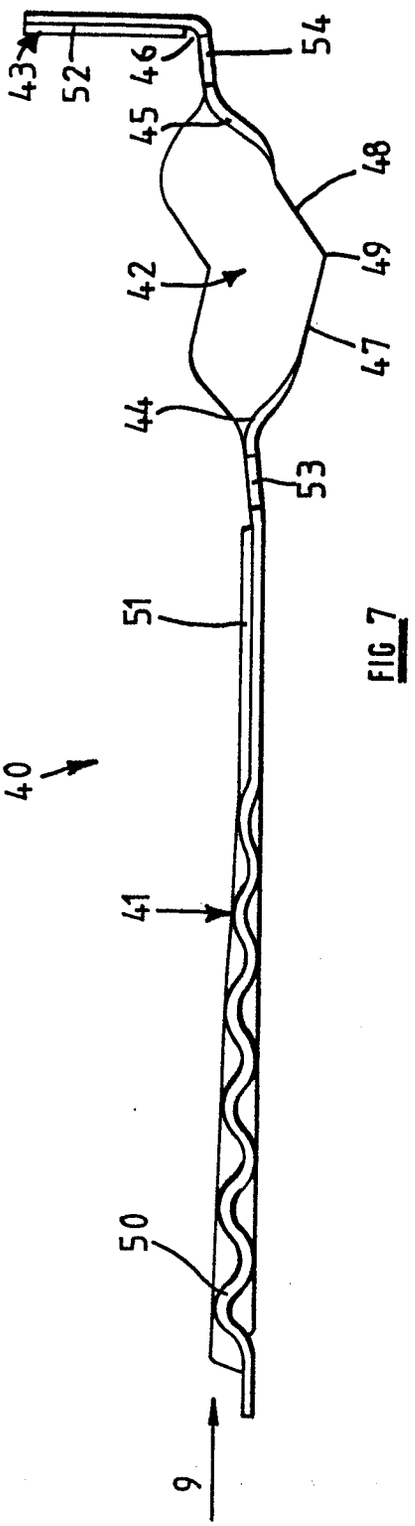
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FIG 7

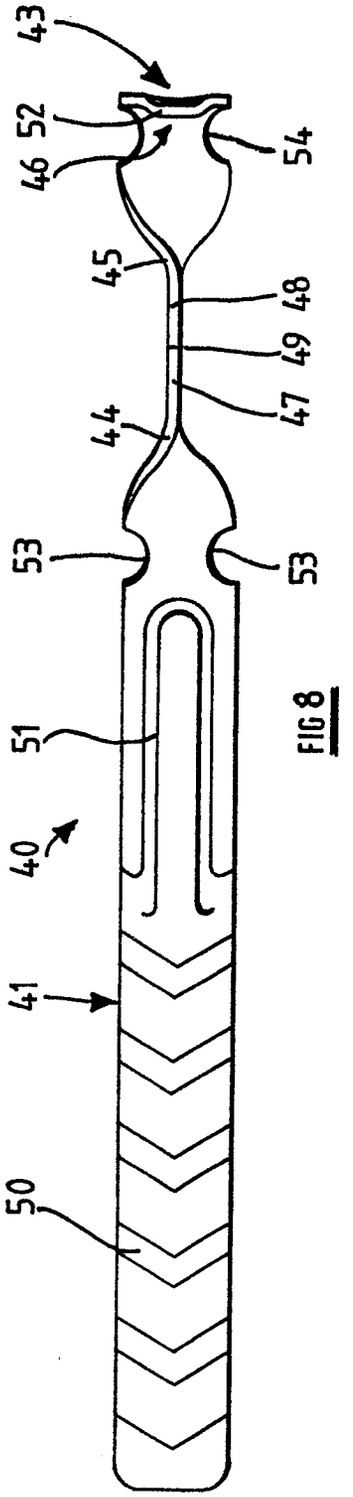
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FIG 8

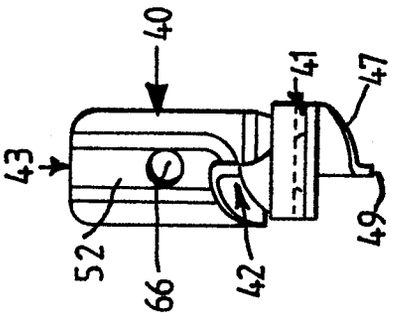

FIG 9

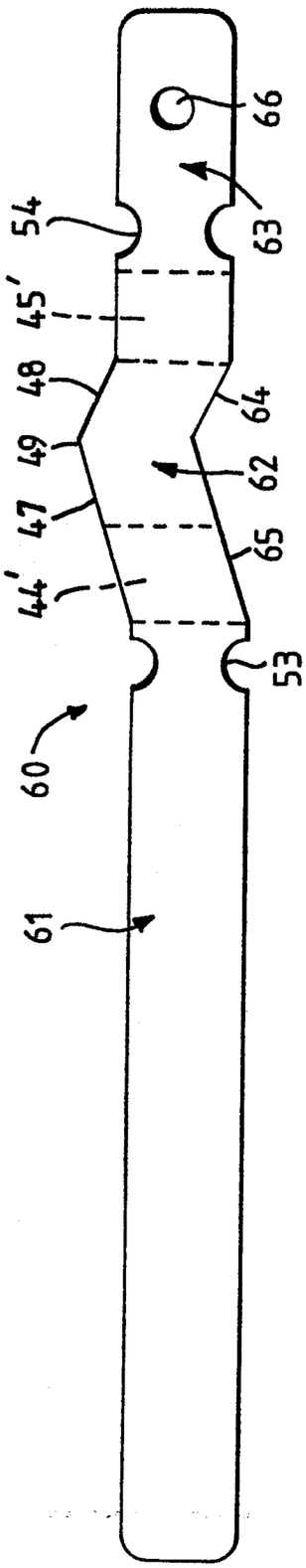

FIG 10

FIG 11

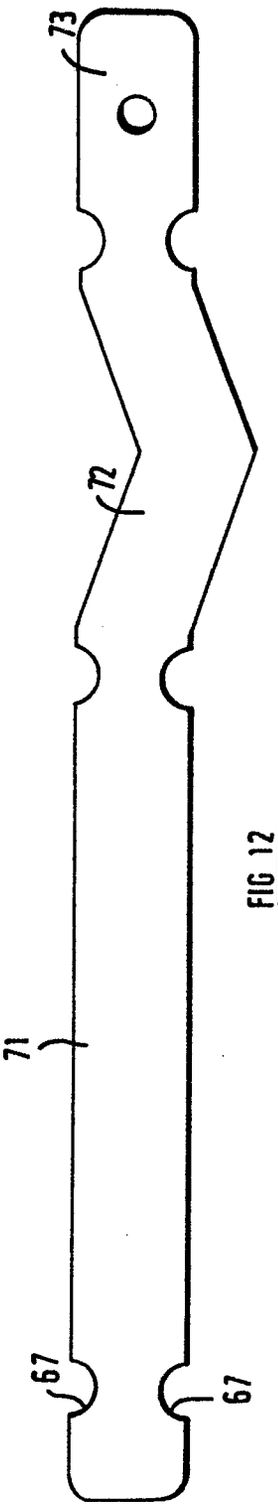

FIG 12

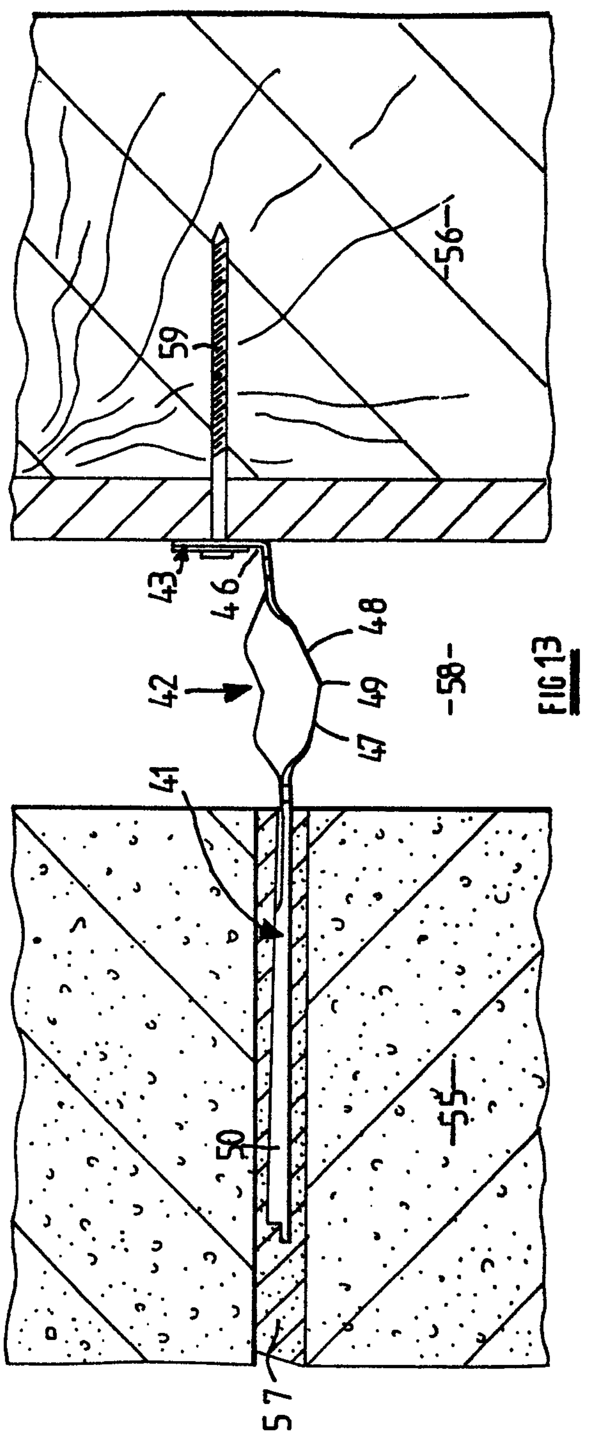
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FIG 13

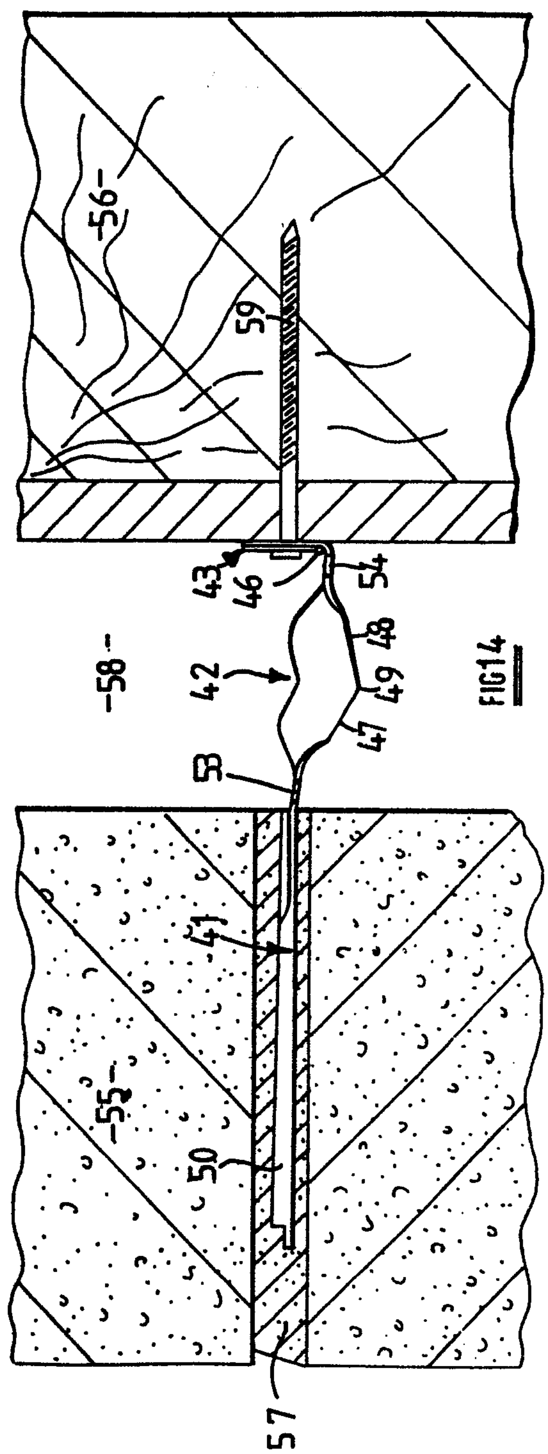
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FIG 14