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(71) Applicant(s):
KEE SAFETY LIMITED
B64 7DW, West Midlands
United Kingdom

(72) Inventor(s):
GRAHAM WILLMOTT

(74) Agent and/or Address for Service:
KEE SAFETY LIMITED
Cradley Business Park
Overend Road, Cradley Heath
B64 7DW, West Midlands
United Kingdom

(54) **Toggle and assembly of toggle and support member**

(57) A toggle (30) comprises a bearer plate (31) which defines a surface for bearing, in use, against the confronting surface of a support structure and a pair of support plates (32) secured to the bearer plate and spaced apart to pivotally support therebetween a barrel (36), said barrel being integral with or connectable to a connector (27) whereby, in use, the connector may secure the toggle bearer plate against the confronting surface (25) of a support structure (24), at least the bearer plate (31) of the toggle being formed from mild steel. There is provided also an assembly of the toggle and a support member, with the connector extending through the support member to secure the bearer plate against a confronting surface of the support member.

Fig.[2]

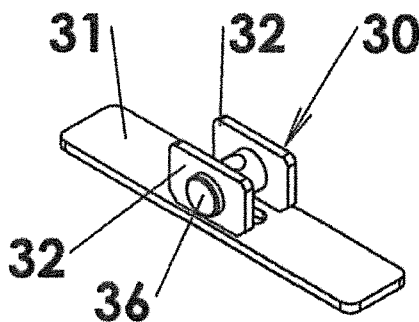


FIG.2

TOGGLE AND ASSEMBLY OF TOGGLE AND SUPPORT MEMBER

This invention relates to an improved toggle and in particular, though not exclusively, to an improved toggle for securing a support member, such as a component of a fall arrest system, to a roof structure. It relates in particular, though not exclusively, to a toggle for use with standing seam and metal profile type roofs. It relates also to the assembly of a toggle and a support member.

It is well known that for a roof top safety installation there may be provided a support member, such as for safety railing or a fall arrest wire, and that that support member may be held in position by means of a retainer comprising, for example, a screw threaded rod which extends through the roof between the support member and a toggle that bears in the assembled condition against the underside of the roof structure thereby to clamp the support member in position on the roof top.

One example of a commonly employed form of installation is that shown at Figure 1 of the accompanying drawings. This shows an anchor plate 10 for resting on the surface of a roof structure and on top of which there is positioned an attachment 12 comprising an aperture 13 which may be employed for attachment of a safety wire. The attachment 12 is clamped in position by means of a screw-threaded rod 11 which engages with a screw threaded internal bore of the attachment 12 to extend through an aperture in the roof structure. A lower end 15 of the rod 11 has pivotally secured thereto a toggle 14 which can lie in a first pivot position alongside the screw threaded rod to allow the rod and toggle to be inserted through an aperture in the roof structure. Subsequently, following insertion, the toggle adopts a substantially horizontal position as illustrated. Clamping of the toggle against the roof structure, and thus also clamping of the attachment 12 to the roof structure is then effected by rotation of the attachment to draw the upper end 16 of the screw threaded rod further into the attachment.

Although a toggle and installation assembly as aforescribed may be suitable for some applications, it does not meet recognised safety standards such as that of EN 795 Type C and relating to support members that are to be employed as part of a fall arrest system.

A particular problem that has been encountered is that of ensuring that not only does the toggle possess sufficient strength to withstand the forces applied during testing or subsequent use, but also of ensuring that the toggle does not damage the roof structure, particularly when the toggle is subjected to load, to such an extent that the strength and integrity of the roof structure is dangerously compromised.

Consideration has been given to use of an array of toggles, typically four toggles, each for securing in position under a respective corner of a mounting plate, as shown in Figure 19. However, whilst that results in a reduction in the load that each toggle needs to withstand, and thus the potential damage which each toggle might inflict on the roof structure, that does not necessarily significantly reduce the load which each toggle and toggle position might experience. In the case of a load applied vertically upwards to a support member it is likely that that applied load would be shared substantially equally between each of a plurality of toggles. However if a sideways load is applied, for example to a support post extending upwards from or part of the support member and which might then tend to cause tilting of the support member, not all of the toggles will provide significant resistance to that tilting movement. Thus there remains a difficulty in ensuring that each toggle itself is sufficiently strong and also does not significantly damage and weaken the roof structure when resisting an applied load.

The present invention teaches that provision of a toggle comprising a bearer plate which defines a surface for bearing, in use, against the confronting surface of a support structure and a pair of support plates secured to the bearer plate and spaced apart pivotally to support therebetween a barrel, said barrel being integral with or connectable to a connector whereby, in use, the connector may secure the toggle bearer plate against the confronting surface

of a support structure, at least the bearer plate of the toggle being formed from mild steel.

The barrel may be provided with a screw threaded aperture into which an end of a screw threaded connector may extend. The screw threaded aperture may be a blind bore or may extend fully through the barrel.

Preferably the barrel support plates are formed from mild steel. Preferably the support plates are secured to the bearer plate by welding, including for example by means of a puddle type weld.

The pivotable barrel may be formed from mild steel.

At least for the purpose of providing a toggle which enables a mounting assembly to comply with the requirements of the aforementioned standards, the bearer plate preferably has a thickness in the range 3mm to 5mm. A thickness of 4mm has been found to be particularly beneficial in providing a bearer plate that when subject to load is able to deform in a manner which is sympathetic to deformation of the surface against which it bears, particularly against the underside surface of a standing seam or metal profile type roof, without puncturing or otherwise substantially weakening the roof whereby the roof itself ceases to be able properly to retain the support member.

The or each support plate preferably has a thickness in the range 3mm to 5 mm.

Preferably each barrel support plate comprises a tongue portion which extends into a respective one of a pair of slots provided in the bearer plate. The tongue portion may be inserted into a respective slot prior to the barrel support plate being welded to the bearer plate.

A typical dimension for the bearer plate is 150mm length and 30mm width. In consequence when employing barrel support plates which are of a thickness of 4mm, and set 2mm inwards from an edge of the bearer plate, the barrel

support plates define therebetween a spacing of 18mm thereby to locate a barrel and accommodate a connector which extends through an aperture in the barrel or which is integral with the barrel.

Particularly if the connector rod extends fully through the barrel, and more particularly if it is a screw threaded connector rod, a slot may be provided in the bearer plate, to lie between the barrel support plates and define an opening through which the end of a (screw threaded) rod may extend as it is rotated relative to the bearer plate when the bearer plate lies substantially perpendicular to the rod, thereby in use to draw the bearer plate into contact with a confronting surface of, for example, a roof structure.

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

Figure 2 is a perspective view of a toggle in accordance with the present invention;

Figures 3, 4 and 5 are respectively plan, elevation and end views of the toggle of Figure 2;

Figures 6 to 9 correspond with Figures 2 to 5 but for clarity omit the pivotable barrel;

Figures 10 to 12 are respectively perspective, plan and end views of the bearer plate of the toggle of Figure 2;

Figures 13, 14 and 15 are respectively perspective, plan and end views of a bearer plate;

Figures 16, 17 and 18 are respectively perspective plan and side views of the barrel of Figure 2;

Figure 19 is a perspective view of a roof installation comprising a toggle according to the present invention, and

Figure 20 is a sectional view of the installation of Figure 19 in a plane containing the two rods 27 of Figure 19.

A toggle 30 comprises a bearer plate 31 and a pair of barrel support plates 32 each formed from 4mm thick mild steel. The support plates each comprise a tongue portion 33 that locates in a respective one of a pair slots 34 in the bearer plate whereby in the assembled condition the barrel support plates extend upwards from the bearer plate, perpendicular thereto and are spaced apart to define a space for accommodating the end of a screw threaded rod.

The bearer plate has a dimension of 150mm by 30mm and the support plates are each inset from longer edges of the bearer plate by 2mm. In consequence the confronting surfaces of the support plates are spaced by 18mm.

Each support plate is formed with an aperture 35 through which a barrel 36 extends and within which the barrel is freely pivotable. The barrel 36 is provided with a screw-threaded aperture 37 into which, in use, a screw threaded rod (not shown) extends. The diameter of the screw threaded rod is at least 8.5mm. In consequence, for a barrel of a length of at least 33mm, the screw threaded rod thereby axially constrains movement of the barrel whereby it is retained in position and supported by each bearer plate.

In known manner the bearer plate is provided with a central slot 40 whereby, when the bearer plate is perpendicular to the screw-threaded rod, with the barrel in the position shown in Figure 3, the end of the rod may be screwed relative to the barrel such that the end of the rod then extends through the slot 40.

Referring to Figure 19, there is illustrated one of four toggles 20 in situ in a roof installation each to secure a respective corner 21 of a plate 22 and associated post 23 relative to the roof structure 24.

In this Figure 19 the bearer plate of the toggle lies aligned with a longitudinally extending trough region 26 of a profiled metal roof panel 25.

However, in use the bearer plate may adopt a position in which it is inclined relative to the length of a trough region. In that case the pivotal freedom of the toggle allows the bearer plate to lie inclined at less than 90 degrees relative to the screw threaded rod 27.

The ability of the mild steel bearer plate to deform in sympathy with local deformation of the panel 25 when under load is most advantageous. That results in an ability to comply with safety standards even if the toggle lies inclined to bear against both of adjacent ridge and trough regions of the roof panel or to span two ridge regions.

This contrasts distinctly and most surprisingly with a toggle formed from a more rigid and potentially stronger material such as stainless steel. It has been found that the relative stiffness of the bearer plate of a stainless steel toggle is likely to puncture a metal roof section thereby to unacceptably damage and compromise the integrity of the roof structure. It is by the use of mild steel that that problem is overcome.

Claims

1. A toggle comprising a bearer plate which defines a surface for bearing, in use, against the confronting surface of a support structure and a pair of support plates secured to the bearer plate and spaced apart to pivotally support therebetween a barrel, said barrel being integral with or connectable to a connector whereby, in use, the connector may secure the toggle bearer plate against the confronting surface of a support structure, at least the bearer plate of the toggle being formed from mild steel.
2. A toggle according to claim 1 wherein the barrel support plates are formed from mild steel.
3. A toggle according to claim 1 or claim 2 wherein each support plate is secured to the bearer plate by means of a weld.
4. A toggle according to any one of the preceding claims wherein the barrel is formed from mild steel.
5. A toggle according to any one of the preceding claims wherein the bearer plate has a thickness in the range 3mm to 5mm.
6. A toggle according to claim 5 wherein the bearer plate has a thickness of 4mm.
7. A toggle according to any one of the preceding claims wherein each barrel support plate has a thickness in the range 3mm to 5 mm.
8. A toggle according to claim 7 wherein each support plate has a thickness of 4mm.

9. A toggle according to any one of the preceding claims wherein each support plate comprises a tongue portion which locates in a respective one of a pair of slots in the bearer plate.
10. A toggle according to any one of the preceding claims wherein each support plate is positioned inwards from an edge of the bearer plate.
11. A toggle according to claim 10 wherein each support plate is set 2mm inwards from an edge of the bearer plate.
12. A toggle according to any one of the preceding claims wherein the barrel is provided with an aperture for receiving a connector.
13. A toggle according to claim 12 wherein said aperture is screw threaded to receive a screw threaded connector rod.
14. A toggle according to any one of the preceding claims wherein the bearer plate comprises a slot positioned between the barrel support plates to define an opening through which an end of a connector may extend.
15. A toggle according to any one of claims 1 to 12 or claim 14 when dependant on any one of claims 1 to 12 wherein the barrel is integral with an elongate connector.
16. A toggle according to any one of the preceding claims wherein the presence of the connector between the support plates ensures that the barrel is held in engagement with each support plate.
17. A toggle according to claim 1 and substantially as herein before described.
18. An assembly comprising a toggle according to any one of the preceding claims and a support member wherein the connector extends

through the support member and secures the bearer plate against a confronting surface of the support member.

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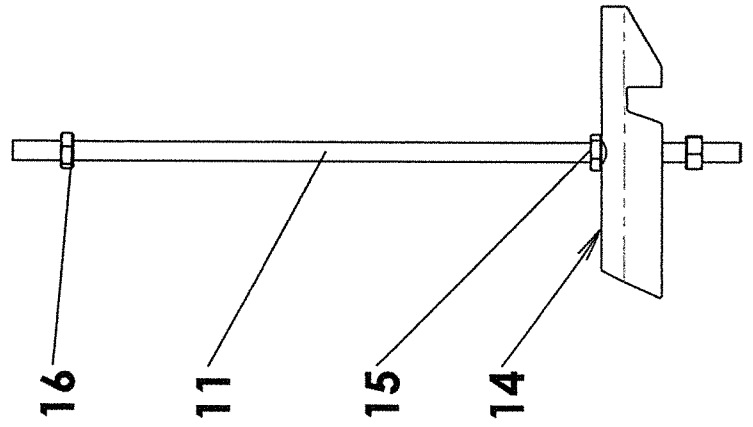
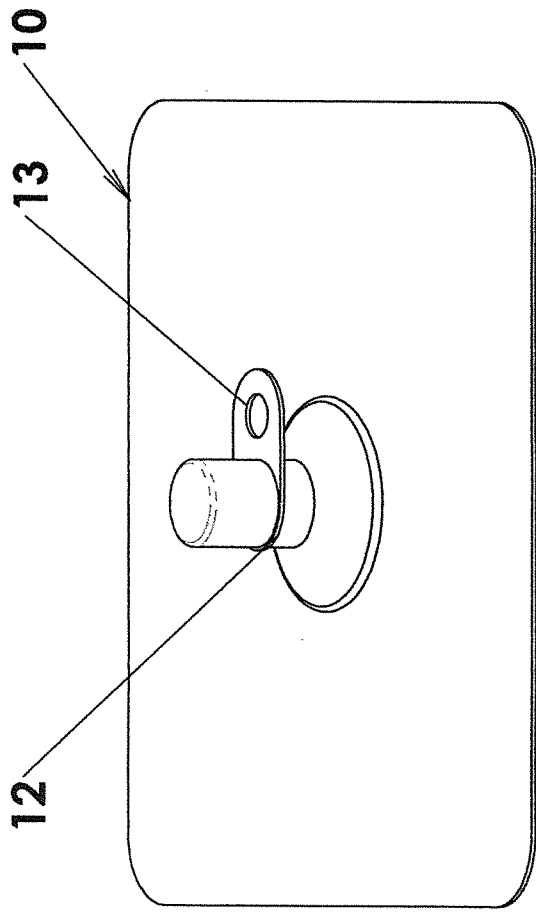


FIG. 1

FULL ASSEMBLY

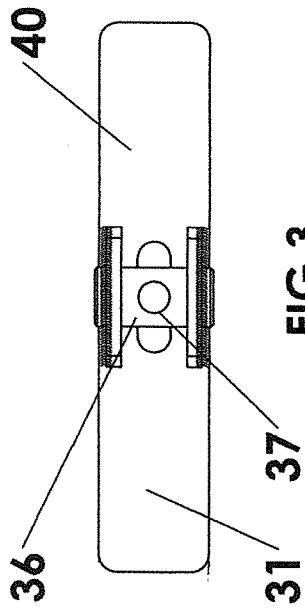


FIG. 3

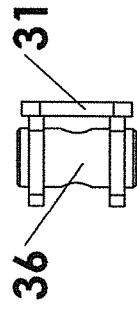


FIG. 5

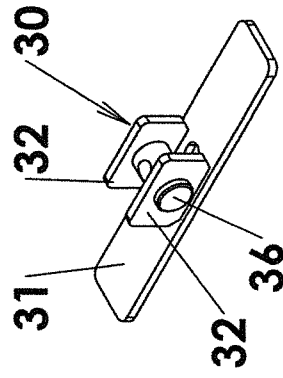


FIG. 2

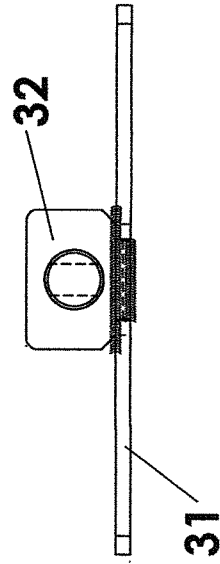
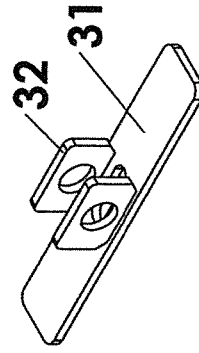
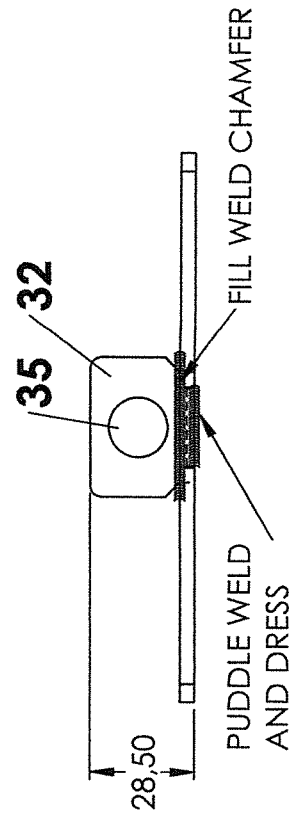
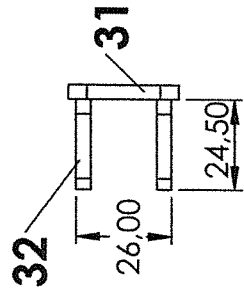
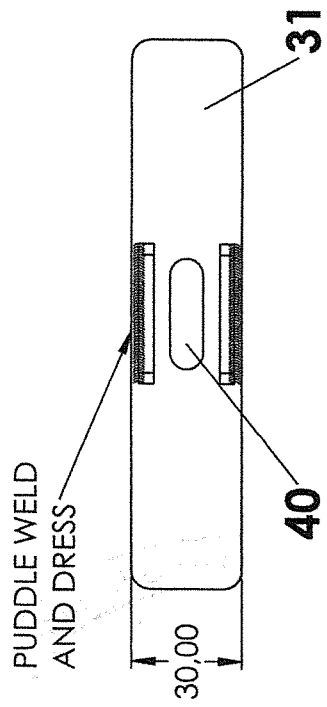


FIG. 4



4MM MILD STEEL PLATES

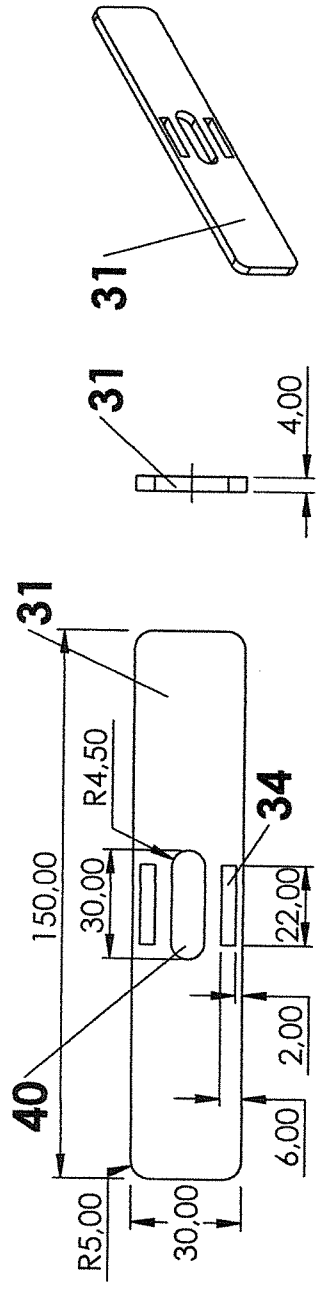


FIG.11

FIG.12

FIG.10

4MM MILD STEEL PLATES

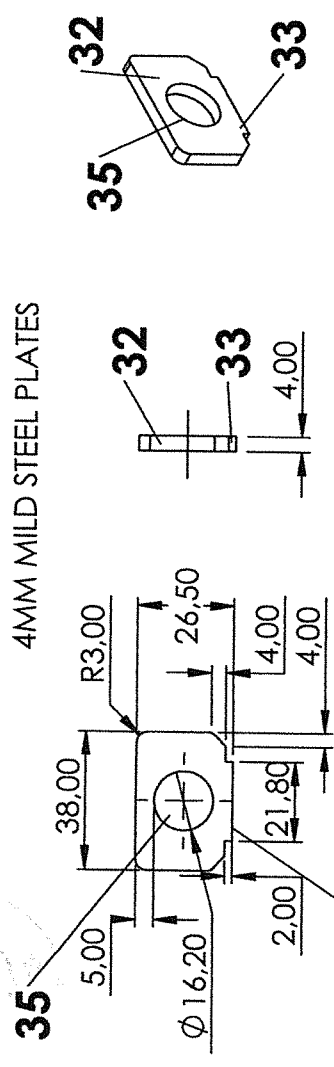


FIG.14

FIG.15

FIG.13

MILD STEEL BAR - BZP FINISH

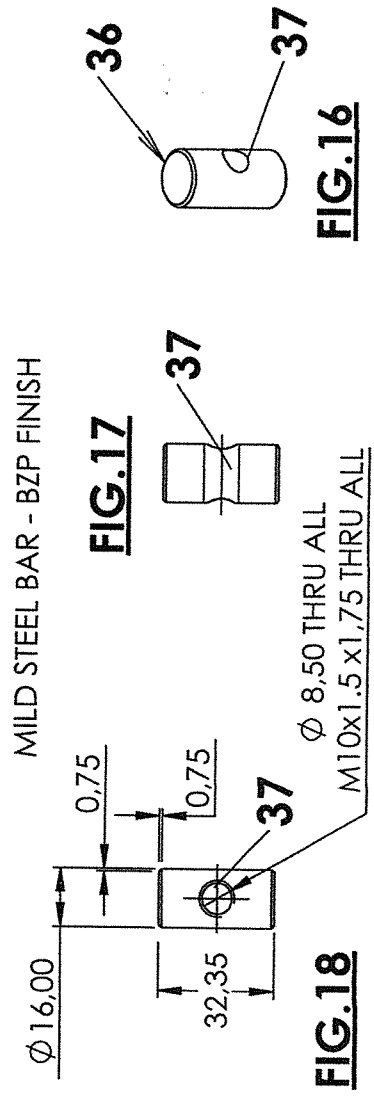


FIG.18

FIG.17

FIG.16

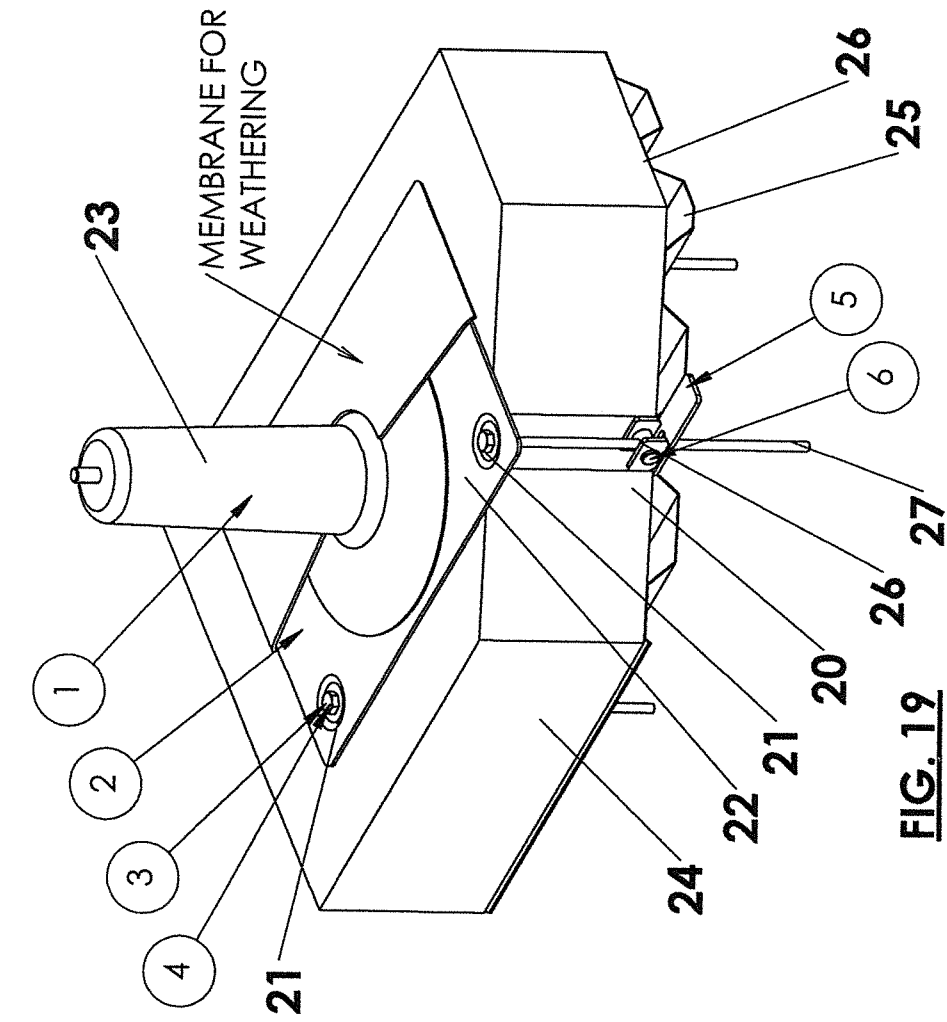


FIG. 19

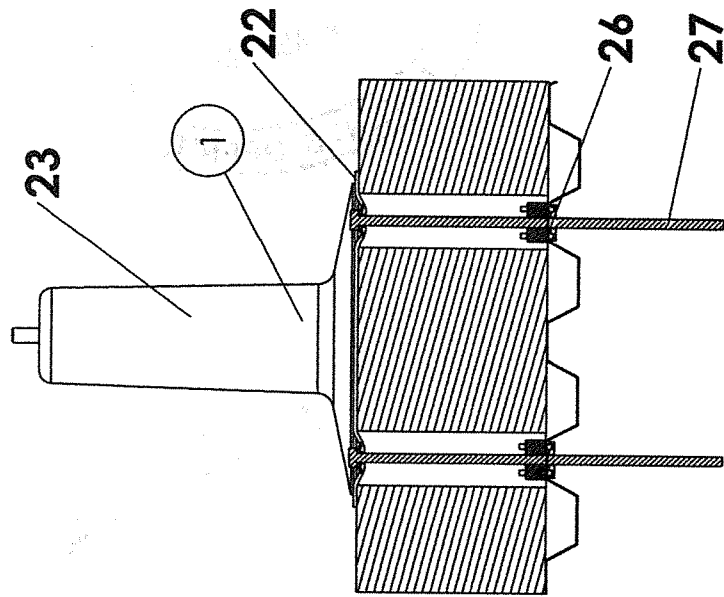


FIG. 20

ITEM No.	DESCRIPTION	QTY.
1	WEATHER CAP	1
2	TOP FIX POST	1
3	M12 x 300.00 HEX HEAD	4
4	TOP HAT FIXING	4
5	TOGGLE	4
6	BARREL	4