(12) UK Patent Application (19) GB (11) 2 184 187 (13) A

(43) Application published **17 Jun 1987**

(21) Application No **8530519**

(22) Date of filing **11 Dec 1985**

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(51) INT CL[4]
F16B 43/00 F16J 15/12

(52) Domestic classification (Edition I)
F2H 15
F2B 1C
U1S 1700 1707 1708 F2B F2H

(56) Documents cited
GB 1553295
GB 1171532
GB 0883464
GB 0875193
GB 0792215

(58) Field of search
F2H
Selected US specifications from IPC sub-class F16B

(54) Washer

(57) A washer (10) which provides a seal between a head (18) of a fastener (17) and a surface (20), comprises a rigid first part (11) sandwiched between and bonded to each of less rigid second and third parts (12,13). The first washer part (11) is metal or rigid plastics, and the second and third parts (12,13) are resilient natural or synthetic rubber. Bonding is by means of a bonding agent or adhesive; cold or hot bonded. The washer parts (11,12,13) may be flat or convex upwards, and may not be co-extensive. The washer may be rectangular in plan, and corrugated or V-shaped or channel-shaped in cross-section. The fastener (17) secures a metal sheet (20) to the stud or purlin (21) of a building.

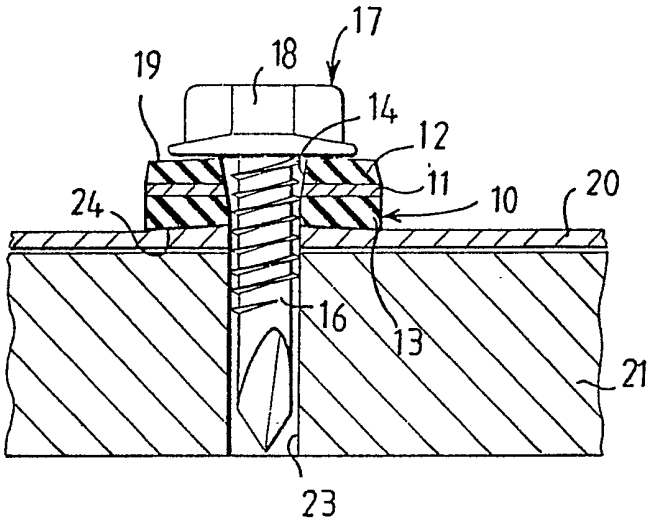

FIG 2

GB 2 184 187 A

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

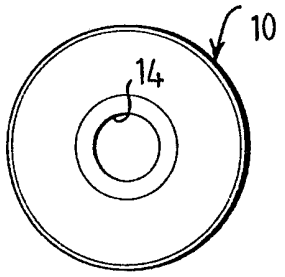

FIG 1

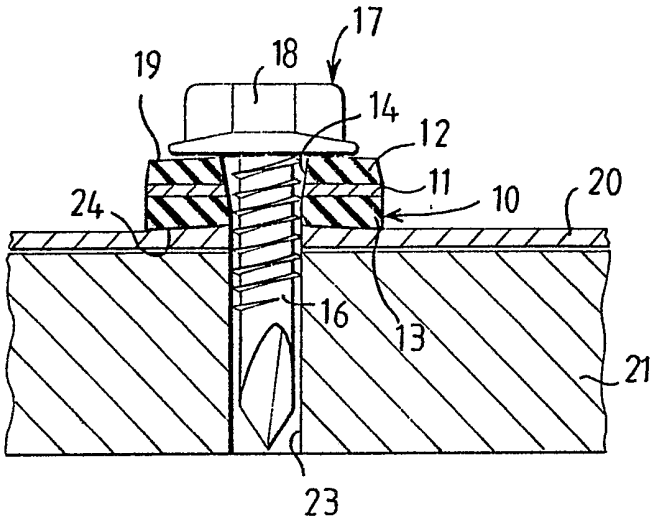

FIG 2

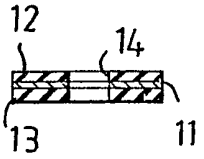

FIG 3b

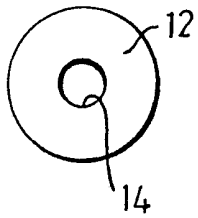

FIG 3a

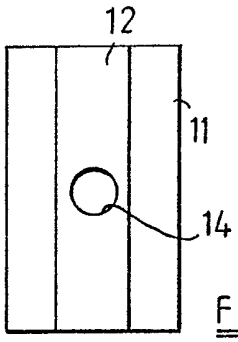

FIG 4a

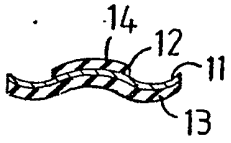

FIG 4b

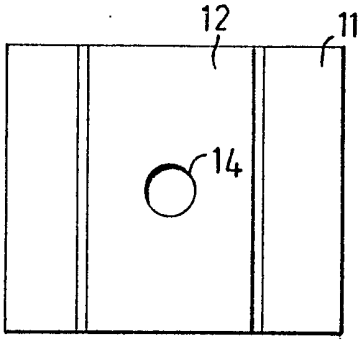

FIG 5a

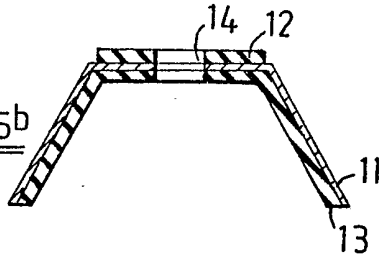

FIG 5b

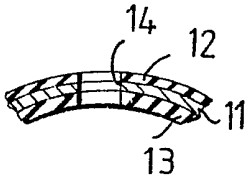

FIG 6a

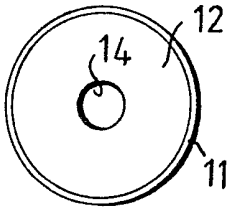

FIG 6b

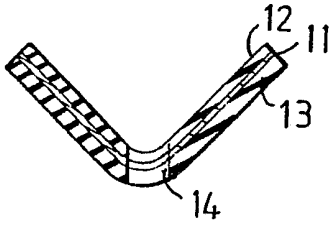

FIG 7b

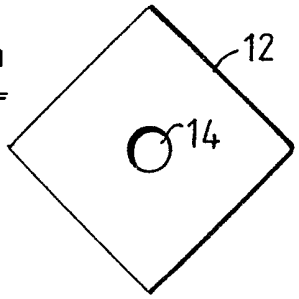

FIG 7a

SPECIFICATION

Washer

This invention relates to a washer, and more particularly a washer which provides a seal between a head of a fastener on which the washer is received, and a surface onto which the fastener extends.

According to one aspect of the invention we provide a washer comprising first, second and third parts, the first part being sandwiched between and bonded to each of the second and third parts, and the first part being made of a material more rigid than the second and third parts.

For example, the first layer may be made of metal or rigid plastics, to give the washer rigidity, whilst the second and third layers may each be made of a resilient material, which may be a natural rubber, synthetic rubber or a mixture of natural and synthetic rubbers, to provide a seal.

In each case, a suitable bonding agent or adhesive will need to be chosen to bond the second and third parts to the first part. One example of a suitable adhesive is a Polyamide resin adhesive.

Sealing washers are well known in the construction industry, particularly where preformed metal sheet is used for cladding and roofing, the sheet being secured to studs or purlins by fasteners. It is desirable to provide a seal between each of the heads of the fasteners and the metal sheets. Sealing washers are known in which a sealing material is moulded to one side of a more rigid material, with part of the material as it is moulded, passing through an opening of the washer and engaging on opposite side of the more rigid material part, but the moulded sealing material tends to become displaced by compression forces to which it is subjected as the fastener is tightened.

Furthermore, production of such washers is expensive.

The present invention overcomes these problems because the strength of the joints between the first and second and first and third parts of the washer can be, by selecting the correct bonding agent or adhesive, adequately strong to resist compression forces which tend to displace the second and third layers, and furthermore, a washer in accordance with the present invention is more economic to produce than known sealing washers in which sealing material is moulded into place.

Preferably the second and third layers are made in a material or as a mixture of materials, selected from the following group of materials namely:

Thermoplastic elastomer/rubber
Neoprene rubber
Ethylene Proplene rubber
Styrene-Butadiene rubber
Nitrile rubber
Natural rubber
Silicone rubber

The second and third parts may be bonded to the first part by cold bonding that is, using a bonding agent or adhesive which bonds at ambient temperatures, or may be bonded to the first part by hot bonding, that is using a thermosetting bonding agent or adhesive.

Hot bonding is sometimes known as "vulcanising" although it will be appreciated to those learned in the art, that vulcanising is the process of hardening rubber by adding sulphur or other agents, usually when the rubber is at an elevated temperature.

The term "hot bonding" used in this specification is thus intended to cover the process of heating the rubber in order to promote setting of the bonding agent or adhesive i.e. the process commonly, but incorrectly, known as "vulcanising".

The first, second and third parts of the washer are preferably all annular providing an opening, preferably a generally central opening, to receive a fastener.

Alternatively, the washer may be of other shapes, such as part spherical, corrugated, but shaped or L shaped, and may have an opening to receive a fastener.

The first, second and third washer parts may be planar, or at least the second and/or third part presents a convex surface, the convex surface of the washer in use, being engaged by the head of a fastener.

Preferably however, the first washer part is of a dished configuration, and one of the second and third washer parts, at least when bonded to the first washer part, presenting a convex surface, whilst the other of the second and third washer parts, at least when bonded to the first washer part, presents a concave surface.

However, it will be appreciated that where the first washer part is dished, as the fastener is tightened, the washer may be flattened.

The second and third parts may be co-extensive with each other and with the first part or may not be co-extensive with each other and extend over different regions of the first part.

For example, the second and third parts may both extend over opposite faces of the first part around the opening therein whilst the third part alone may extend to the periphery of the first part on one face thereof whilst the second part may have an outer periphery spaced within the outer periphery of the first part.

According to a second aspect of the invention we provide a combination of a fastener having a head and a shank, and a washer in accordance with the first aspect of the invention, the shank of the fastener passing through a generally central opening of the washer, and the head of the fastener engaging one of the second and third washer parts.

According to a third aspect of the invention we provide a construction comprising a first member and a second member, the first and second members being secured together by a fastener passing through an opening in the first member into the second member, a washer in accordance with the first aspect of the invention being interposed between a head of the fastener and the first member to provide a seal therebetween.

The first member may be generally sheet-like, such as preformed metal cladding or roofing sheet, and the second member may be a stud or purlin member.

Thus the construction in accordance with the third aspect of the invention may comprise a building construction.

The invention will now be described with the aid of the accompanying drawings in which:

Figure 1 is a plan view of a washer in accordance with the invention,

Figure 2 is a side sectional view through the washer of Figure 1, in use, and,

Figures 3a, b, to *7a, b* are respectively plan and sectional views through other embodiments of the invention.

Referring to Figures 1 and 2 of the drawings, a washer 10 comprises three parts, namely a first centre part 11, a second top part 12 and a third bottom part 13.

Each of the three washer parts 11, 12, and 13 have aligned generally central openings 14 and thus are of generally annular form.

The first washer part 11 is preferably made in metal, but could be made in any other material more rigid than the second and third washer parts 13 and 14. For example, the first more rigid washer part 11 could be made in a rigid plastics material if desired.

The second and third washer parts 12 and 13 are preferably made from a resilient material. In one example, the second and third rubber parts are made from thermoplastic elastomer/rubber, Neoprene rubber, Erthylene Proplene rubber, Styrene-Butadiene rubber, Nitrile rubber, natural rubber, or a silicon rubber, or a mixture of any of these, or one of the second and third parts may be made of one of these mixtures or other of the second and third parts may be made from a different one of these materials.

Both of the second and third washer parts 12 and 13 are bonded to the first washer part 11 by a suitable bonding agent or adhesive.

Such a bonding agent or adhesive may permit cold bonding between the washer parts 11, 12 and 13 or heat may be required to premote setting, if the adhesive is a thermosetting adhesive for example. One example of a suitable adhesive is a polyamide resin adhesive.

As can be seen in Figure 2, the opening 14 provided in each of the three washer parts 11, 12, 13, receives a shank 16 of a fastener 17, the fastener 17 having a head 18 which engages an upper surface 19 of the second washer part 12.

The fastener 17 secures together a first member 20 which, in the present example, comprises a preformed metal sheet of a building construction, and a second member 21, which in the present example comprises a stud or purlin of a building. The shank 16 of the fastener passes through an opening 22 in the first member 20 and into an aligned opening 23 in the second member 21.

It will be appreciated that as the fastener 17 is tightened, the washer 10 will become firmly sandwiched between the head 18 of the fastener 17, and the first member 20, and because of the nature of the material of the second and third washer parts 12 and 13, effective sealing will be achieved between the head 18 of the fastener and the second washer part 12, and between the third washer part 13 and the first member 20, whilst the first washer part 12, being of a more rigid material, will give the washer 10 adequate mechanical strength and rigidity. In addition, sealing will be achieved between the shank 16 of the fastener 17 and each of the second and third washer parts 12, 13, as they are deformed into sealing engagement with the shank 16 as the fastener 17 is tightened.

To assist sealing, it can be seen that the upper surface 19 of the second washer part 12 with which the head 18 of the fastener 17 engages, is slightly convex, whilst the undersurface 24 of the third washer part which engages the first member 20, is slightly concave. The first washer part 11 is itself slightly dished, and the second and third washer parts 12 and 13 assume their convex/concave shape when they are bonded to the first washer part 11.

Thus any moisture e.g. rain, falling on the upper surface 19 of the washer 10, will not tend to move towards the shank 16 of the fastener, but will tend to run from the convex surface 19.

Other configurations of washer embodying the invention are shown in Figures 3*a*, 3*b*, to 7*a*, 7*b*. Figures 3*a* and 3*b* show a washer similar to that shown in Figures 1 and 2 but where the washer is of a flat annular shape. The second and third washer parts 12, 13, are co-extensive with the first washer part 11.

Figures 4*a*, 4*b* show a washer which is rectangular in plan view and of corrugated shape in cross section. The first second and third washer parts 11, 12, 13, are not co-extensive, the second washer part 12 extending over the first washer part 12 only in the region around the opening 14 whilst the third washer part 13 extends to the outer periphery of the first washer part on the bottom face thereof.

Figures 5*a* and 5*b* show a washer which is rectangular in plan view and of truncated shape in cross section. Again the second and third washer parts 12 and 13 are not co-extensive and the second washer part 12 extends over only the central region of the first part 11, whilst the third part 13 covers the whole of the bottom surface of the first part 11.

Figures 6*a* and 6*b* show a washer similar to that of Figure 1 but of part spherical shape. The first second and third washer parts 11 and 13 are co-extensive.

Figures 7*a* and 7*b* show another modification in which the first second and third washer parts are co-extensive but in this case, the first part is square in plan view and generally V shape in cross section, the root of the V lying on a diagonal of the square.

If desired, the washer may have other shapes to those described hereinbefore.

Although the invention has been described in relation to a building construction, of course a washer 10 in accordance with the invention may be used in combination with any other fastener and in any other application as required.

The features disclosed in the foregoing description, in the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, or a class or group of substances or compositions, as appropriate, may

separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS

1. A washer comprising first, second and first parts, the first part being sandwiched between and bonded to the second and third parts, the first part being made of a material more rigid than the second and third parts.

2. A washer in accordance with Claim 1 wherein the first washer part is made of metal.

3. A washer in accordance with Claim 1 wherein the first washer part is made of rigid plastics.

4. A washer according to any one of Claims 1 to 3 wherein the second and third layers are each made of a resilient material.

5. A washer according to any one of the preceding claims wherein a suitable bonding agent or adhesive bonds the second and third parts to the first part.

6. A washer according to Claim 5 wherein the adhesive is a polyamide resin adhesive.

7. A washer according to any one of the preceding claims wherein the second and third layers are made in a material, or as a mixture of material selected from the following group of materials namely:

Thermoplastic elastomer/rubber
Neoprene rubber
Ethylene rubber
Styrene-Butadiene rubber
Nitrile rubber
Natural rubber
Silicone rubber

8. A washer according to any one of Claims 1 to 7 wherein the second and third parts are bonded to the first part by cold bonding.

9. A washer according to any one of Claims 1 to 7 wherein the second and third parts are bonded to the first part by hot bonding.

10. A washer according to any one of the preceding claims wherein the first, second and third parts of the washer are all generally annular providing a generally central opening.

11. A washer according to any one of the preceding claims wherein the first, second and third washer parts are planar.

12. A washer according to any one of Claims 1 to 10 wherein at least the second and/or third parts presents a convex surface, the convex surface of the washer in use, being engaged by the head of a fastener.

13. A washer according to Claim 12 wherein the first washer part is of a dished configuration, and one of the second and third washer parts, at least when bonded to the first washer part, presents a convex surface whilst the other of the second and third washer parts, at least when bonded to the first washer part, presents a concave surface.

14. A washer according to any one of the preceding claims wherein the second and third parts are co-extensive with each other and with the first part.

15. A washer according to any one of claims 1-13, wherein the second and third parts are not co-extensive with each other and with the first part and extend over different regions of the first part.

16. A washer according to Claim 15 wherein the second and third parts extend over opposite faces of the first part around the opening therein whilst the third part alone extends to the periphery of the first part on one face thereof and the second part has an outer periphery spaced within the outer periphery of the first part on the opposite face thereof.

17. A washer substantially as hereinbefore described with reference to Figures 1 and 2 or Figures 3*a*, 3*b* or Figures 4*a*, 4*b* or Figures 5*a*, 5*b* or Figures 6*a*, 6*b* or Figures 7*a*, 7*b* of the accompanying drawings.

18. A combination of a fastener having a head and a shank, the shank extending through a generally central opening of a washer according to any one of Claims 1 to 17 wherein the head of the fastener engages one of the second and third washer parts.

19. A combination of a fastener and washer substantially as hereinbefore described with reference to and as shown in Figure 2 of the accompanying drawings.

20. A construction comprising a first member and a second member, the first and second members being secured together by a fastener which passes through an opening in the first member into the second member, a washer according to any one of Claims 1 to 17 being interposed between a head of the fastener and the first member.

21. A construction according to Claim 20 wherein the first member is generally sheet-like.

22. A construction according to Claim 20 or Claim 21 wherein the first member is a preformed metal cladding or roofing sheet and the second member is a stud or purlin member.

23. A construction according to any one of Claims 20-22 wherein the second washer part engages the head and the shank of the fastener and the third washer part engages the first member and the shank of the fastener.

24. A construction substantially as hereinbefore described with reference to Figures 1 and 2, or Figures 3*a*, 3*b* or Figures 5*a* 5*b* or Figures 6*a*, 6*b*, or Figures 7*a*, 7*b*, of the accompanying drawings.

25. Any novel feature or novel combination of features disclosed herein and/or shown in the accompanying drawings.

Printed for Her Majesty's Stationery Office by
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