

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) FASTENING ELEMENT

(71) I, ARTUR FISCHER, a German Citizen, of 7241 Tumlingen, Grunmettsterstrasse 133, Germany, do hereby declare the invention, for which we pray that patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a fastening element, and in particular to such a fastening element for connecting thin plates or for fastening a cladding plate to a wall.

The present invention provides a fastening element comprising a shank portion formed with an axial bore and a plurality of legs extending longitudinally from one end of the shank portion, the free ends of the legs being retained, in use, in a hole in a plate-like member, the portion of each leg adjacent the shank being outwardly inclined to the longitudinal axis of the element, the portions of the legs adjacent their free ends defining a substantially cylindrical surface coaxial with the shank portion, and the portion of each leg adjacent its free end being thinner in transverse cross-section than its inclined portion, in which the inclined portion of each leg emerges with its thinner portion to define a ledge.

Preferably, the fastening element further comprises a screw which is co-operable with a screw-threaded portion of the bore so that, in use, the shank portion can be drawn towards the free end of the legs to cause each leg to bend at its ledge. As a result, the legs will bend radially outwardly exactly at the ledges when the screw engaging the shank portion is tightened and will collapse axially as the tightening of the screw progresses. Due to the inclined leg portions the free ends of the legs are situated, when under no constraint, on a diameter larger than the diameter of the hole in which the fastening element passes through a plate, and the legs are compressed in the end region so as to

become situated within the hole diameter when the fastening element is inserted in such a hole. Therefore, the leg portions remaining behind the plate receive an outward bend in the region of the ledges.

In a preferred embodiment, the free end of each leg is provided with a radially outwardly extending flange. With this design it is possible to insert the fastening element in the hole without a screw having been inserted in the element beforehand because the combined flanges prevent the fastening element from being inadvertently slipped through the hole.

Advantageously, each of the legs is provided with ridges on the outer surface of that portion which, in use, engages the hole of the plate-like member. These ridges constitute a safeguard against inadvertent rotation during the tightening of the screw. Moreover, the ridges also have the effect that the legs are so compressed towards one another in the region of the hole that they touch each other. In this way, the fastening element is firmly held in the hole without any clearance.

In a particularly advantageous embodiment of the invention the shank portion is provided in the form of an expansible sleeve, known per-se.

The invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 shows a fastening element;

Fig. 2 the fastening element of Fig. 1 connecting two plates together;

Fig. 3 a fastening element similar to that of Fig. 1 connecting a cladding plate to a wall; and

Fig. 4 shows a perspective view of another form of fastening element.

Referring to the drawings, Fig. 1 shows a fastening element consisting of a shank portion 1, having a longitudinal bore 2 provided

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with an inner thread 3. Four legs 4 extend longitudinally from the shank portion 1, the free ends 5 of the legs being retained in a hole 6 of one or more thin plates 7 (see Fig. 2). The legs 4 are each constituted by a portion 8, which merges with the shank portion 1 and a portion 9, which is thinner in transverse cross-section than the portion 8. At the point of transition between the two portion 8 and 9, which corresponds to the prospective bending point 10, a ledge 11 is formed on the inside of the legs 4. The leg portions 8 are outwardly inclined to the longitudinal axis 12, the leg portions 9 extending substantially parallel with the longitudinal axis 12. At their free ends the legs 4 each have a radially outwardly extending flange 13 which engages the outer surface of the outer plate 7 in the region surrounding the hole.

When a fastening screw 14 is screwed into the inner thread 3 of the longitudinal bore 2 of the shank portion 1, this shank portion is drawn towards the rear surface of the inner plate 7. During this process the legs 4 bend out radially at the point 10 and thus are collapsed in axial direction. The thinner leg portions 9 end up flat against the rear surface of the inner plate 7, whereas the thicker leg portions 8 are supported indirectly on the rear surface of the plate 7 at a distance from the rim of the hole 6, and also on the shank portion 1. The forces acting upon the connection are thus distributed over a comparatively large area around the rim of the hole 6, so that the material surrounding the hole cannot break and the collapsed legs cannot be drawn into the hole. The thinner leg portions 9 which, due to the circular cross section of the fastening element, are originally curved, are pressed flat as they apply themselves to the back of the inner plate 7 over a large surface area. This results in a low specific surface load—an advantage especially when the fastening element is employed in connection with plaster sheets.

Due to the fact that the legs 4 are compressed to within the area of the hole 6, they apply themselves resiliently to the inner surface of the hole 6 and this gives added protection against inadvertent rotation. The fastening element is advantageously manufactured from synthetic material by an injection moulding process, the necessary moulds being comparatively simple.

In Fig. 3, the shank portion 1 of a fastening element is provided in the form of an expansion plug 15, known per se, that can be anchored in a hole 16 of a wall 17. The free ends of the legs 4 form a recess at 18 to receive the head 19 of a countersunk fastening screw 20. The anchoring of a cladding sheet 21 is achieved in that the fastening element is slipped through a bore 22 of

the cladding sheet 21 and into the bore 16 of the wall 17 so that the cladding sheet 21 is maintained at a predetermined distance from the wall 17. When the fastening screw 20 is screwed in, the plug 15 expands in the bore 16 of the wall 17, and the legs 4 bend radially outwardly, as has been described above with respect to the embodiment of Figs. 1 and 2, and are collapsed axially, the thinner leg portions 9 applying themselves to the rear surface of the sheet 21, while the thicker leg portions 8 ensure the support of the plate 21 relative to the wall 17. The predetermined distance is chosen to be the distance at which the sheet 21 is desired to be from the wall 17 plus the distance through which the legs 4 axially collapse. This design offers the advantage that the distance between cladding sheets 21 and wall 17 can be finely regulated without having to loosen the plug 15 which has already become firmly anchored.

Fig. 4 shows a fastening element similar to that of Fig. 1 except that it has only two legs 4. This element is particularly useful for joining together two plates 7 having holes 6 of small diameter therein. The thicker leg portions 8 which, at one end, are supported on the shank portion 1 of the fastening element and, at the other end, on the back of the inner plate 7 are sufficiently rigid, due to their substantially half-shell cross-sectional shape, to enable the shank portion 1 to be drawn in towards the rear surface of the plate 7 and, thus, for the bending of the legs 4 to terminate at a point at which the thicker leg portions 8 still extend at an acute angle relative to the longitudinal axis. In this way, the axial load acting upon the fastening element is supported in the manner of a pylon by the legs 4 at the back of the inner plate 7, the bending points 10 being spaced apart and away from the rim of the hole 6. This occurs because the shank portion 1 has already been drawn sufficiently far towards the rear surface of the inner plate 7 for the thinner leg portions 9 to be flattened against this rear surface.

In the case of fastening elements of comparatively large diameter it will be necessary to provide four legs because, due to the half-shell cross-sectional shape the moment of resistance to bending in the case of only two legs would become too large. On the other hand, in fastening elements of large diameter having four legs, a similar effect is achieved as with fastening elements of smaller diameter with two legs.

WHAT I CLAIM IS:—

1. A fastening element comprising a shank portion formed with an axial bore and a plurality of legs extending longitudinally from one end of the shank portion, the



with an inner thread 3. Four legs 4 extend longitudinally from the shank portion 1, the free ends 5 of the legs being retained in a hole 6 of one or more thin plates 7 (see Fig. 2). The legs 4 are each constituted by a portion 8, which merges with the shank portion 1 and a portion 9, which is thinner in transverse cross-section than the portion 8. At the point of transition between the two portion 8 and 9, which corresponds to the prospective bending point 10, a ledge 11 is formed on the inside of the legs 4. The leg portions 8 are outwardly inclined to the longitudinal axis 12, the leg portions 9 extending substantially parallel with the longitudinal axis 12. At their free ends the legs 4 each have a radially outwardly extending flange 13 which engages the outer surface of the outer plate 7 in the region surrounding the hole.

When a fastening screw 14 is screwed into the inner thread 3 of the longitudinal bore 2 of the shank portion 1, this shank portion is drawn towards the rear surface of the inner plate 7. During this process the legs 4 bend out radially at the point 10 and thus are collapsed in axial direction. The thinner leg portions 9 end up flat against the rear surface of the inner plate 7, whereas the thicker leg portions 8 are supported indirectly on the rear surface of the plate 7 at a distance from the rim of the hole 6, and also on the shank portion 1. The forces acting upon the connection are thus distributed over a comparatively large area around the rim of the hole 6, so that the material surrounding the hole cannot break and the collapsed legs cannot be drawn into the hole. The thinner leg portions 9 which, due to the circular cross section of the fastening element, are originally curved, are pressed flat as they apply themselves to the back of the inner plate 7 over a large surface area. This results in a low specific surface load—an advantage especially when the fastening element is employed in connection with plaster sheets.

Due to the fact that the legs 4 are compressed to within the area of the hole 6, they apply themselves resiliently to the inner surface of the hole 6 and this gives added protection against inadvertent rotation. The fastening element is advantageously manufactured from synthetic material by an injection moulding process, the necessary moulds being comparatively simple.

In Fig. 3, the shank portion 1 of a fastening element is provided in the form of an expansion plug 15, known per se, that can be anchored in a hole 16 of a wall 17. The free ends of the legs 4 form a recess at 18 to receive the head 19 of a countersunk fastening screw 20. The anchoring of a cladding sheet 21 is achieved in that the fastening element is slipped through a bore 22 of

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Fig. 4 shows a fastening element similar to that of Fig. 1 except that it has only two legs 4. This element is particularly useful for joining together two plates 7 having holes 6 of small diameter therein. The thicker leg portions 8 which, at one end, are supported on the shank portion 1 of the fastening element and, at the other end, on the back of the inner plate 7 are sufficiently rigid, due to their substantially half-shell cross-sectional shape, to enable the shank portion 1 to be drawn in towards the rear surface of the plate 7 and, thus, for the bending of the legs 4 to terminate at a point at which the thicker leg portions 8 still extend at an acute angle relative to the longitudinal axis. In this way, the axial load acting upon the fastening element is supported in the manner of a pylon by the legs 4 at the back of the inner plate 7, the bending points 10 being spaced apart and away from the rim of the hole 6. This occurs because the shank portion 1 has already been drawn sufficiently far towards the rear surface of the inner plate 7 for the thinner leg portions 9 to be flattened against this rear surface.

In the case of fastening elements of comparatively large diameter it will be necessary to provide four legs because, due to the half-shell cross-sectional shape the moment of resistance to bending in the case of only two legs would become too large. On the other hand, in fastening elements of large diameter having four legs, a similar effect is achieved as with fastening elements of smaller diameter with two legs.

WHAT I CLAIM IS:—

1. A fastening element comprising a shank portion formed with an axial bore and a plurality of legs extending longitudinally from one end of the shank portion, the



free ends of the legs being retained, in use, in a hole in a plate-like member, the portion of each leg adjacent the shank being outwardly inclined to the longitudinal axis of the element, the portions of the legs adjacent their free ends defining a substantially cylindrical surface coaxial with the shank portion, and the portion of each leg adjacent its free end being thinner in transverse cross-section than its inclined portion, in which the inclined portion of each leg merges with its thinner portion to define a ledge.

2. A fastening element as claimed in Claim 1, further comprising a screw which is co-operable with a screw-threaded portion of the bore so that, in use, the shank portion can be drawn towards the free end of the legs to cause each leg to bend at its ledge.

3. A fastening element as claimed in Claim 1 or Claim 2, in which the free end of each leg is provided with a radially outwardly extending flange.

4. A fastening element as claimed in any

one of Claims 1 to 3, in which each of the legs 4 is provided with ridges on the outer surface of that portion which, in use, engages the hole of the plate-like member.

5. A fastening element as claimed in any one of Claims 1 to 4, in which the shank portion is provided in the form of an expansible sleeve known per se.

6. A fastening element as claimed in any one of Claims 1 to 5, in which two legs are provided.

7. A fastening element as claimed in any one of Claims 1 to 5, in which four legs are provided.

8. A fastening element substantially as hereinbefore described with reference to, and as illustrated by, Figs. 1 and 2, Fig. 3 or Fig. 4 of the accompanying drawings.

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