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(54) **Fastening Device**

(57) This fastening device, notably for fixing an object to a hollow partition or wall, comprises a splined deformable plug 1, a screw 2 and a nut 3; the bottom of each gap 7 formed between the splines 6 is provided with a slit 9, except at the plug ends, to enable the splines 6 to separate and expand when contracted as a consequence of the tightening of the nut 3 by means of the screw 2; the nut 3 carries deformable lugs 8 corresponding to the gaps 7 formed between the plug splines 6 so that when the device is tightened home the lugs 8 registering with the gaps 7 engage the latter to assist in reinforcing the locking action exerted by the expanded and twisted splines 6 against the inner face of the partition.

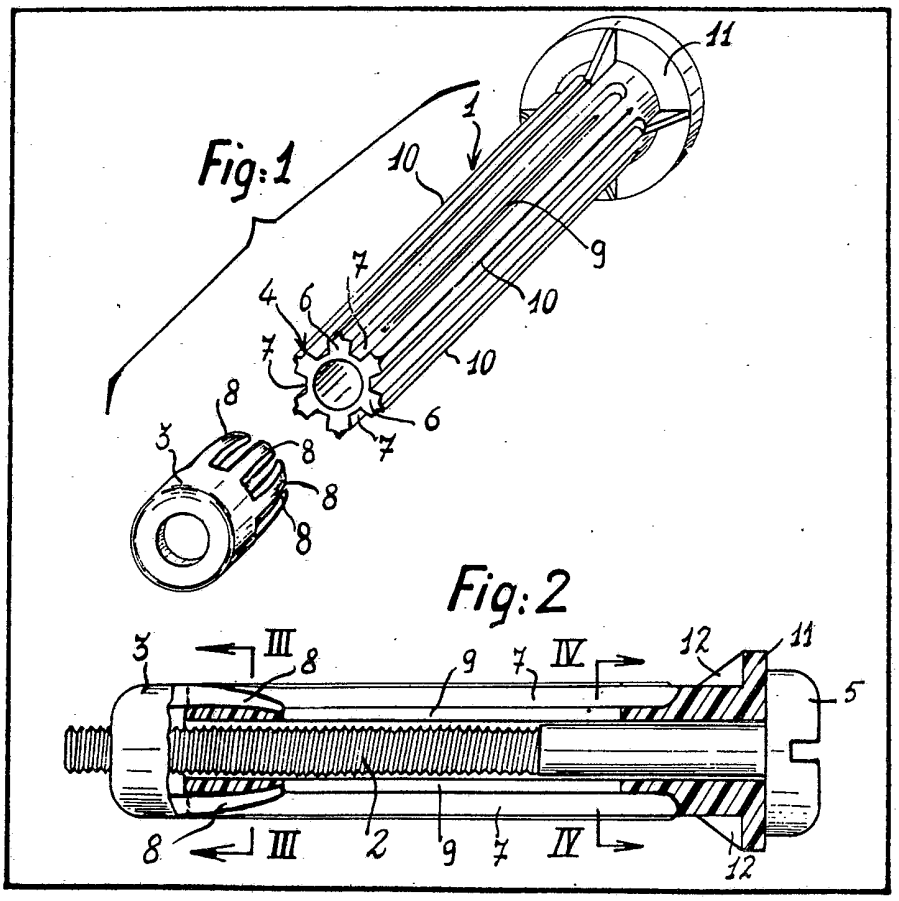

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Fig:1

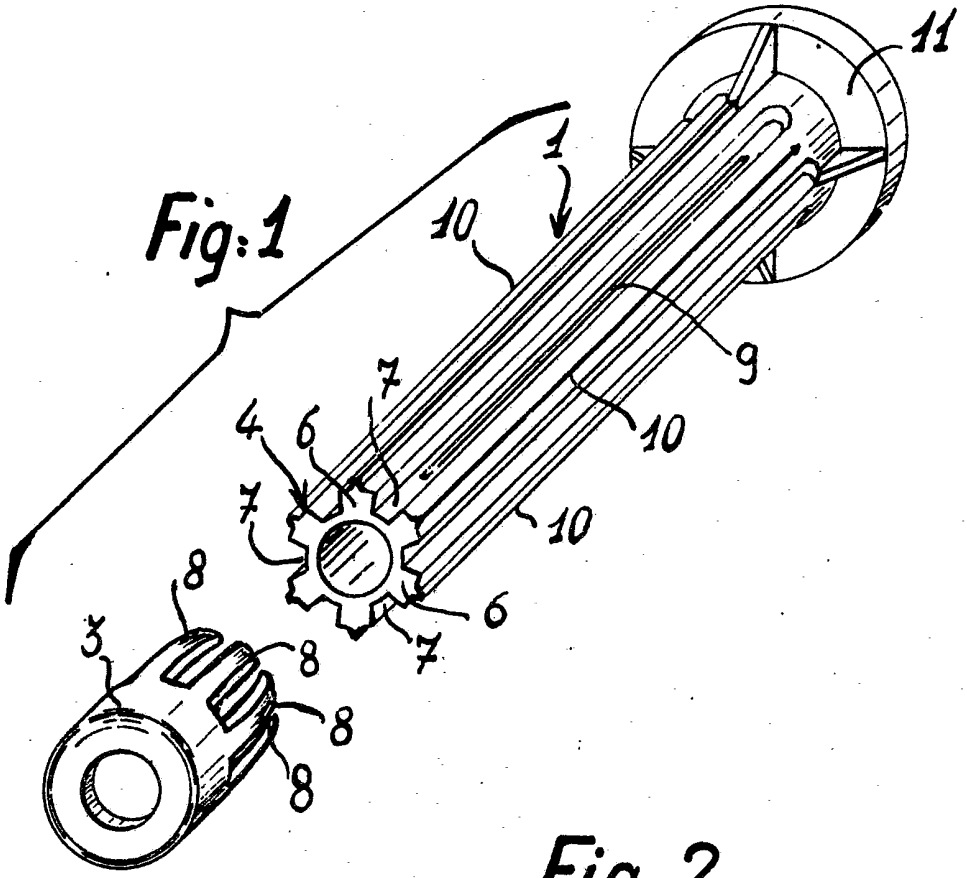


Fig:2

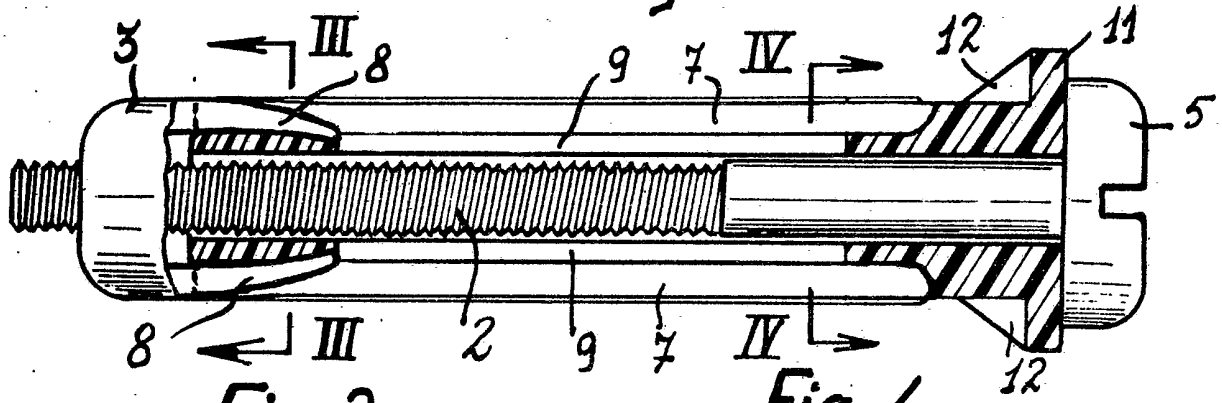


Fig:3

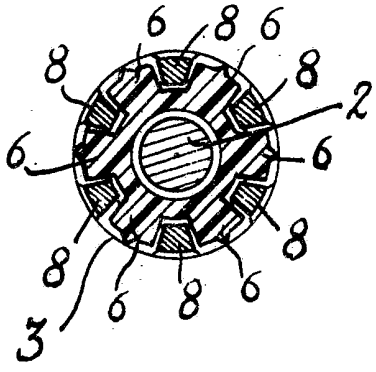


Fig:4

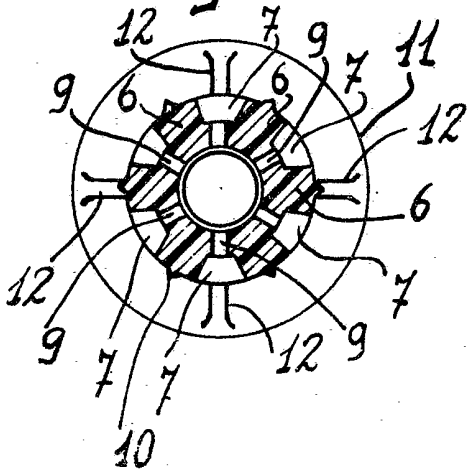


Fig:5

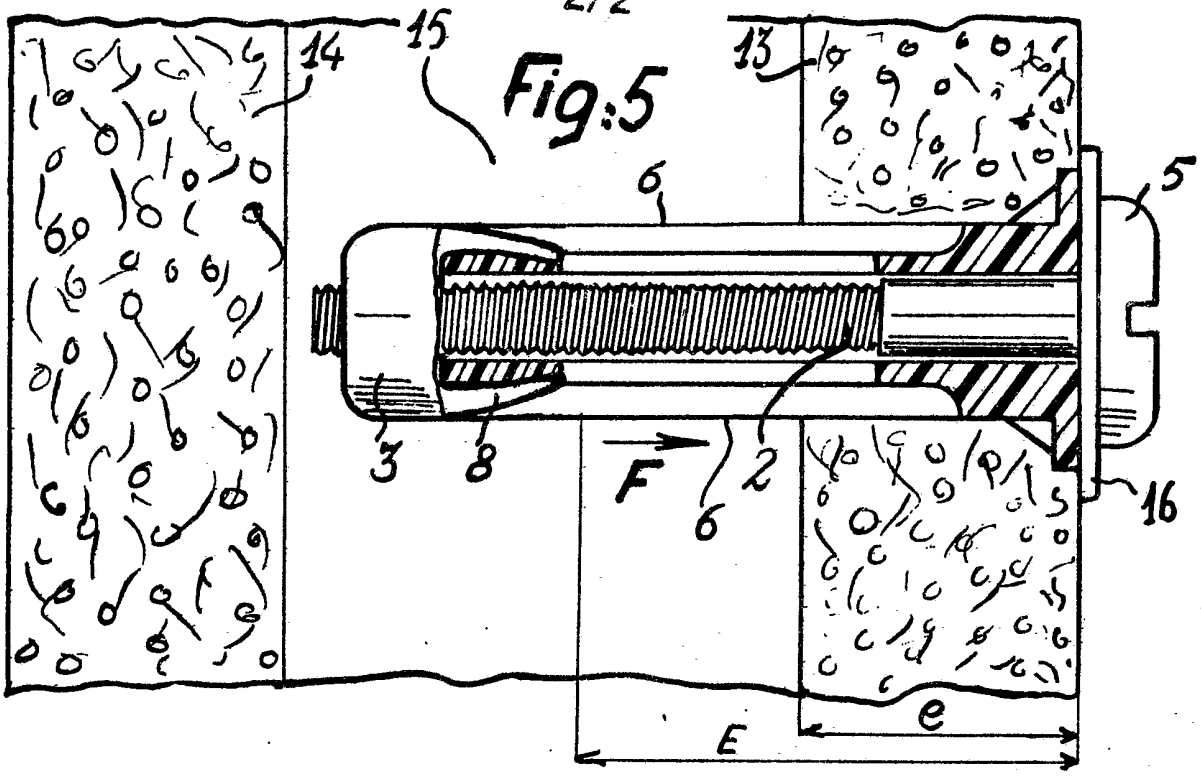


Fig:6

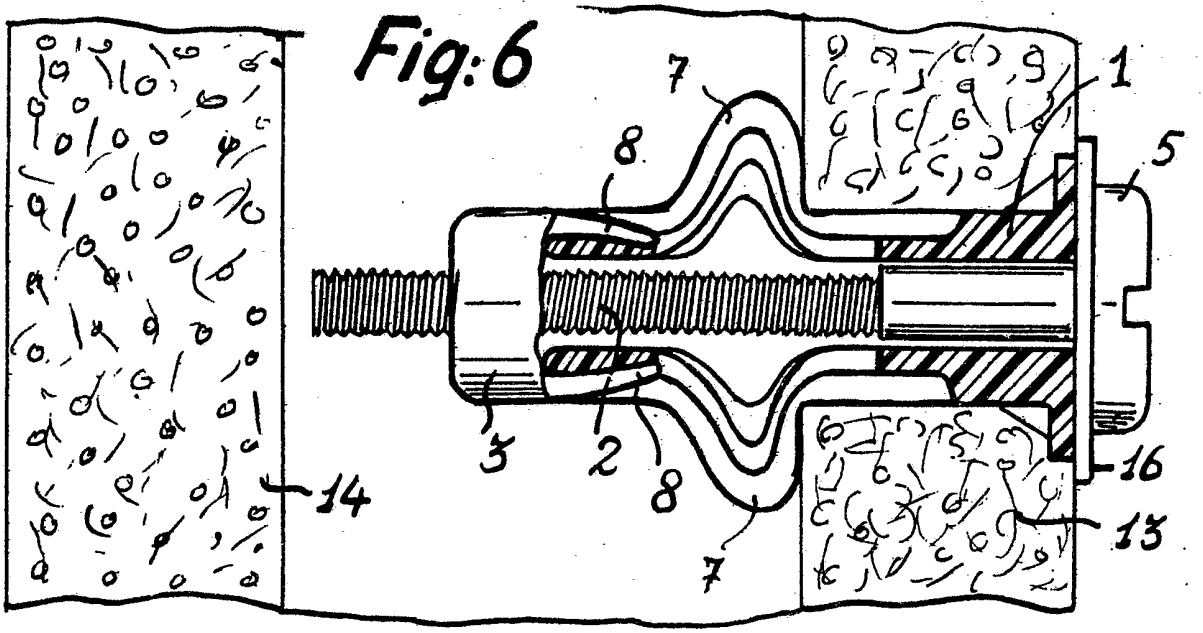
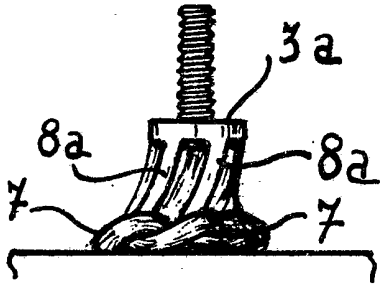


Fig:8



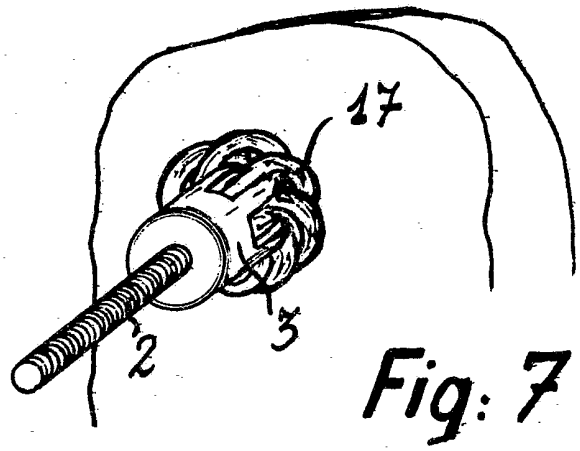


Fig: 7

SPECIFICATION
Fastening Device

This invention relates to a fastening device for securing any element or object to a wall or partition. This device is intended more particularly for fixing objects to hollow walls or to walls made of a relatively brittle material, notably chipboard or porous concrete.

This device is of the type wherein a tightening screw is provided inside a tubular plug of deformable material disposed between the screw head and a nut carried by the opposite end of the screw. On the other hand, on at least one portion of the plug length, a plurality of longitudinal weakening lines forming flexible splines between them are formed.

Under these conditions, when the screw is tightened for moving the nut towards the screw head, the plug is caused to expand, so that the flexible splines undergo a deformation and may even become loose in relation to each other, due to the weakening lines provided for this purpose. The distortion of the plug and more particularly of the splines thereof is intended for anchoring the fastening device in the bore into which the same has been introduced.

However, in actual practice it was observed that the anchoring action obtained with plugs of this specific type is not always reliable, due to the fact that this action results only from the distortion of the deformable splines of the plug, which does not occur under the best possible conditions since the tightening nut can rotate in relation to the plug during the plug expansion.

Besides, in most instances, due to the resiliency of the plug material no tearing effect is observed within the weakening lines separating the adjacent splines of the plug. Therefore, these splines remain attached to one another and this precludes the possibility of producing a sufficient torsion of the splines on themselves in order to provide a really efficient fastening device. In fact, the plug is simply expanded and this is not sufficient for obtaining a fully efficient anchorage.

It is the primary object of this invention to provide a fastening device of the type set forth hereinabove, but so designed as to impart a considerably improved efficiency thereto under substantially all fixing conditions.

For this purpose, the tightening nut comprises on its plug-facing end a plurality of integral deformable lugs corresponding in number to the gaps or grooves existing between the longitudinal splines formed on the outer surface of the plug, and each lug is engageable in one of these gaps. On the other hand, the bottom of each gap or groove has formed therein a slit equally spaced from the pair of adjacent splines, this slit extending throughout the plug length except at the two ends thereof.

Due to the engagement of the nut lugs between the plug splines, the nut is rotatably solid with the corresponding end of the plug and therefore cannot rotate in relation thereto during the plug rotation and distortion. Consequently, the plug splines distortion takes place under the best possible conditions, inasmuch as they are not likely to remain attached to each other, since they are originally separated by the slits formed in the gaps between adjacent splines. Now, when tightening the screw, a combined torsion and contraction stress is applied to the splines at their ends adjacent the nut. Under these conditions, the splines eventually provide a particularly efficient anchoring "knot".

In this respect, it may be noted that the efficiency of the fastening device of the present invention is improved considerably by the provision of integral deformable lugs on the tightening nut. In fact, during the tightening action exerted by the screw, these splines are caused to expand simultaneously with the distortion of the plug splines. Thus, the nut lugs bear against the inner face of the corresponding wall or partition through the medium of the distorted end portion of the plug.

A double anchoring action is thus obtained, and this constitutes a particularly advantageous feature of the fastening device of this invention.

However, other features and advantages of this invention will appear as the following description proceeds with reference to the accompanying drawing.

Figure 1 is a perspective view of the plug and nut assembly constituting the improved fastening device of this invention;

Figure 2 is an axial longitudinal sectional view of the device;

Figures 3 and 4 are cross-sectional views taken along the planes III—III and IV—IV of Figure 2, respectively;

Figure 5 is a fragmentary longitudinal section showing the same device after its insertion through a bore made in a hollow partition, but before tightening the screw;

Figure 6 is a view similar to Figure 5 showing the condition of the device during the fastening operation and before the latter is completed;

Figure 7 is a perspective view showing the "knot" formed by the splines at the end of the fastening operation, and

Figure 8 is an elevational view showing the anchoring knot obtained with a modified form of embodiment of the fastening device of this invention.

The improved fastening device of the present invention, as shown in Figures 1 to 4, comprises a tubular plug 1 of deformable material, through which a screw 2 provided with a tightening nut 3 is inserted. The nut normally registers with the inner end 4 of the plug, i.e. the end adapted to be introduced first into the bore formed through the wall or partition. The head 2 of the screw 2 registers with the opposite end of the plug.

Formed on the outer, substantially cylindrical surface of plug 1 are a plurality of spaced longitudinal splines 6 extending throughout the plug length and separated by gaps or grooves 7. Nos, on its face registering with the plug 1, the

nut 3 has formed a plurality of projection lugs 8 corresponding in number to said gaps 7, so that each gap 7 receives a corresponding lug 8 at the corresponding end 4 of the plug (see Figures 3 and 2). Preferably, the lugs 8 are slightly curved inwardly and their inner radial dimension at their tip is such that they resiliently clamp the plug end 4. It will also be seen that these lugs 8 are advantageously flexible, the nut 3 being manufactured from a suitable resilient or slightly deformable material, or any other adequate material.

In the bottom of each gap 7, intermediate the adjacent splines 6 of the plug, a longitudinal slit 9 is formed. These slits extend throughout the plug length, except at the ends thereof. Thus, the splines 6 are completely independent of each other along the greater part of their length.

Preferably, these splines are each provided with a sharp-edged median rib 10 extending throughout the spline length. The function of these ribs 10 is to prevent the plug from rotating about its axis during the first few turns of the screw 2. In fact, in this case the ribs 10 grip the inner wall of the bore in which the fastening device is inserted.

As already mentioned in the foregoing, this device is intended notably for use when any object has to be fastened against a hollow partition such as the partition shown in Figures 5 and 6, which comprises two portions 13, 14 separated by an air gap 15. The length E of the plug 1 is in this case considerably greater then the thickness *e* of the first portion 13 of this partition. Thus, the plug 1 will protrude along a substantial portion of its length within the air gap 15 extending between the wall portions 13 and 14, in which the tightening nut 3 carried by the screw is located. In the example illustrated in Figures 5 and 6, the device of this invention is used for securing to the corresponding partition a fastening lug 16 solid with an object, the screw 2 extending through a hole formed in this lug 16.

When the screw 2 is turned in the tightening direction, the nut is prevented from rotating by the plug 1 and translated in the direction of the arrow F, Figure 5. Thus, the longitudinal splines 6 of the plug are contracted and therefore caused to expand along their portions located outside the first portion 13 of the partition.

However, when a relatively strong resistance counteracts the translation of nut 3, continuing the screw rotation will cause the nut proper to rotate until it is locked completely. Now, this nut rotation is attended by the torsion or twisting of the longitudinal splines 6 of the plug, at least in the previously contracted portions thereof.

Under these conditions, the splines are eventually caused to form a kind of knot 17 in the form of a rosette, as shown in Figure 7. This knot constitutes a particularly efficient anchoring means strongly adhering to the inner face of the first portion 13 of the partition.

It will also be seen that the anchorage knot thus obtained is reinforced by the lugs 8 of nut 3 which have been opened out somewhat but remain still engaged in the gaps 7 formed between the plug splines 6 at the corresponding end of the plug. Besides, it may be emphasized that the deformable lugs of nut 3 have likewise undergone a certain torsion like the corresponding portion of the plug splines. Therefore, these lugs become an integral part of the anchoring knot so as to reinforce same, inasmuch as said lugs are opened out so as to partake efficiently in the fastening action of the device. Thus, the device of this invention is safely protected against any accidental removal, even when the device is used for securing relatively heavy objects to a wall or partition.

Figure 8 illustrates the anchorage device obtained by using a different form of embodiment of the present invention in which the deformable lugs 8*a* of the corresponding nut 3*a* are somewhat longer and thinner than those of the preceding form of embodiment. In this case, a more pronounced torsional effort is exerted on the lugs 8*a* so that their diverging tips are sunk into the knot formed by the twisted splines 7 of the plug. Thus, the resulting anchoring action is more reliable.

However, a more or less accentuated torsion of the deformable nut lugs may be obtained, together with a more or less pronounced outflaring of these lugs, by varying the length and cross-sectional dimension of these lugs, or alternatively by choosing a different material for manufacturing the nuts. In fact, the nut may be made from metal stock or moulded from a synthetic resin of adequate strength.

The plug proper, considering its specific structure may be manufactured in the form of a continuous extruded rod. In fact, the splines 6 as well as the ribs 10 may easily be obtained by extrusion. The slits 9 may on the other hand be formed after cutting the various sections which are to constitute as many plugs.

On the other hand, each plug may advantageously comprise an annular flange 11 at its end adjacent the screw head 5. In this case, the inner face of flange 11 is connected to the plug body or shank by means of a plurality of triangular, spaced radial fins 12.

Finally, it will be readily understood by those conversant with the art that notwithstanding the presence of this flange and of the radial fins, the plug may also be manufactured from a continuous extruded rod. In fact, the flange 11 and fins 12 may be formed after cutting each plug-forming section by introducing the latter into a suitable mold comprising on the other hand a cavity adapted to receive the plug body and on the other hand an impression shaped to form its end flange 11 and the associated radial fins 12.

Claims

1. Fastening device to be inserted into a bore formed through a partition or wall, which is characterised in that it comprises in combination:—

a tightening screw provided with a head adapted to engage the outer surface of the partition;

a nut engaging the screw and opposite the screw head;

a tubular plug of deformable material, surrounding said screw and disposed between the screw head and the nut;

on the outer surface of the plug, a plurality of spaced longitudinal splines separated by gaps;

in the bottom of each gap, a slit extending along at least one portion of the plug length, except at the ends of the plug;

on the face of the nut which registers with the plug end, a series of deformable lugs equal in number to the gaps formed between the longitudinal splines on the plug;

each nut lug engaging a corresponding gap formed between two adjacent longitudinal splines of the plug.

2. Fastening device according to claim 1, characterised in that the deformable lugs formed on the tightening nut are slightly curved inwardly and adapted to clamp the corresponding plug end between them.

3. Fastening device substantially as described with reference to the accompanying drawings.

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