

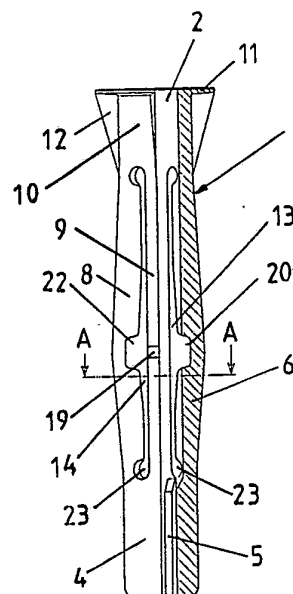


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification<sup>5</sup> :</b> <b>F16B 13/06, 13/14, E04B 1/48</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 90/08265</b> <b>(43) International Publication Date:</b> 26 July 1990 (26.07.90)
<b>(21) International Application Number:</b> PCT/SE90/00009 <b>(22) International Filing Date:</b> 4 January 1990 (04.01.90) <b>(30) Priority data:</b> 8900069-9                      11 January 1989 (11.01.89)      SE <b>(71) Applicant (for all designated States except US):</b> THORS- MAN 6 CO AB [SE/SE]; Box 1010, S-611 29 Nyköping (SE). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only) :</b> SUNDSTRÖM, Inge [SE/SE]; Prästkragevägen 38, S-611 45 Nyköping (SE). <b>(74) Agent:</b> BAUMBACH, Thorkild; Ankarvägen 4, S-761 40 Norrtälje (SE).		<b>(81) Designated States:</b> AT (European patent), AU, BE (Euro- pean patent), CH (European patent), DE (European pa- tent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), IT (Euro- pean patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), US.  <b>Published</b> <i>With international search report.</i> <i>With amended claims.</i> <i>In English translation (filed in Swedish).</i>

**(54) Title:** A PLUG**(57) Abstract**

Fastening device in the form of a universally usable plug (1) designed for cooperation with a screw (3) intended to be arranged in a pre-drilled hole (15) in a building component (16, 18) irrespective of the fact that this is composed of board material (18) having a cavity behind and is solid respectively. The plug (1) which has a central hole (2) comprises, in its fixed condition, an inner end portion (4) arranged to receive and grip the thread of the cooperating screw (3), four legs (6-9) extending from the inner end portion and an outer end portion (10) in which the legs join. Due to the fact that the legs (6-9) have an increasing width in the direction of the central part and are designed with sectional weakenings (19-22) at the center it is achieved on one hand that at the application of the plug in a solid material (16) the plug (1) will be expanded by the screw (3) and bear on four sectors of the wall of the hole, and on the other hand at the application of the plug (1) in a board material or equivalent the four legs are broken outwards at the back side of the board (18) preferably in radial direction. Hereby an even distribution of the pressure against the edge of the hole is achieved by the creation of four contact points.



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A PLUG.

The present invention refers to a fastening device in the form of a plug, preferably made of plastic material, having a central, longitudinal hole for cooperation with a fastening element in the form of a screw or equivalent and  
5 intended to be arranged in a pre-drilled hole in building components of practically all types from board covered stud walls, light concrete walls, hollow brick walls or brick walls to casted concrete walls which plug comprises, in its fixed condition, an inner end portion in the penetrating  
10 hole of which a thread is arranged or measures have been taken in order to facilitate thread cutting, four legs extending from the inner end portion and an outer end portion in which the legs join and which comprises a stop flange or equivalent for bearing on the edge of the hole.

15  
Several different embodiments of such universal plugs for use in hollow walls as well as in walls of solid material are known. In the first mentioned case the plug is put in a through hole in the support and in the latter case in a  
20 dead end hole. When the known plugs are arranged in a through hole in a board it is intended that, at the introduction of the cooperating screw in the inner end portion, the plug should be contracted axially and the legs should be bent or broken preferably radially outwards  
25 creating a support at the back side of the board. In order to facilitate the bending of the legs the known plugs are as a rule made from a relatively soft plastic material. This means that the part of the plug on the back side of the board will rotate more or less during the introduction  
30 of the screw depending on the design of the plug and the material of the same and the legs will position themselves over each other. Such plugs of soft material mounted in wall boards of plaster have, however, shown to give less withdrawal resistance than plugs made from hard plastic  
35 material which plugs do not tend to rotate as much and bear better on the hole edge. Plugs of a harder material also

show a considerable increase of moment indicating when the screw is sufficiently tightened which eliminates the risk of damaging the plug or the edge of the hole.

5 On plugs of hard plastic material the legs will, however, not be easily bent or broken radially outwards. In order to facilitate the breaking outwards the legs use to be provided with bending notches in combination with a slight deviation of the legs. The deviation is achieved by means  
10 of the fact that the common sectional form of the legs, the number of which due to manufacturing reasons is limited to two, at the middle portion of the plug, forms an ellipse which in the direction of the end portions transforms into a circle. Such a plug comprising two legs with a middle  
15 portion having an elliptical section is known from the European Patent EP-A-0169335.

For use of universal plugs in dead end holes it has also been shown advantageous to make the plug from a relatively  
20 hard material which does not have cold flow properties which would cause the plug to lose its grip in the wall as time goes on. The axial contraction of the universal plug is in hard wall materials, however, not sufficient to ensure the grip of the plugs in the wall. The enlarging of  
25 the middle portions of the legs shown in said European Patent gives an essential improvement of the expansion properties of such a plug. The expansion of the plug takes place, however, only in two opposite directions and the withdrawal resistance does not reach values corresponding  
30 to values for known expansion plugs designed for hard wall materials. These plugs are usually divided in four legs by means of radial slots.

The object of the present invention is to provide a  
35 universally usable fastening device in the form of a plug by means of which it is possible to achieve with all types

of supports values for the withdrawal resistance corresponding values attainable by means of fastening devices especially designed for each type of support. A further object is to provide a plug which by means of its design makes it possible to be produced by injection moulding in an injection tool of the same relatively simple design, with regard to the number of moving parts, which plugs comprising only two legs allow. These objects are attained by giving the plug the characteristics of the following claims.

An embodiment of the device will be described more in detail with reference to the accompanying drawing in which figure 1 shows a plug in a side view, figure 2 shows the same plug rotated 90° around its longitudinal axis in a side view and partly sectioned, figure 3 shows a section A-A through the center portion of the plug, figure 4 shows a plug arranged in a sectioned board, figure 5 shows the plug according to figure 4 seen from the back of the board and figure 6 shows a plug arranged in a sectioned, solid building component.

The fastening device according to the invention comprises a plug 1 of preferably plastic material, which is provided with an axially arranged hole 2 adapted for cooperation with a screw 3. The plug 1 comprises, in its fixed condition, an inner end portion 4 in which the through hole 2 is provided with an inner thread or, as shown in figures 2 and 3, internal ridges 5 in which the screw at the introduction in the plug cuts threads. From the inner end portion 4, four legs 6-9 extend which join in an outer end portion 10 which is provided with a flange 11 and means 12 to stop rotation of the plug. The four legs are created by means of two slots 13,14 arranged in essentially parallel planes having an increasing width in the direction of the central part of the plug. The central portions of the legs

6-9 are somewhat divergent and the plug has its largest part in the transverse direction at this central part. Due to the fact that the inner surfaces of the legs 6-9 are limited by the circular hole 2 and thus are straight in axial direction, the legs have also their largest thickness at the center part. Figure 3, which shows a section A-A through the plug, also shows that the design of the outer profile of the legs is such that if the legs are pressed to bear on each other for example by the introduction of the plug in a dead end hole 15, having nominal diameter, in a building component 16, as shown in figure 6, then the center part will have essentially the same diameter as the end portions. Hereby a contraction will be created in the center portion of the hole 2, through which the cooperating screw 3 at the fastening of an object 17 will be screwed creating a wedge effect and the plug will expand and be caused to bear on four sectors of the wall of the hole with considerable force.

At the fastening of an object 17 on a board formed building component according to figures 4 and 5 by means of introducing the cooperating screw 3 in the hole of the inner end portion provided with ridges 5, said end portion is pulled in the direction of the back side of the board 18. Hereby the legs 6-9 are bent or broken radially outwards which is facilitated on one hand by the fact that the legs are somewhat divergent and on the other hand by the fact that the legs are provided with sectional weakenings in the form of notches 19-22 arranged at the center parts of the legs. Of these notches, the notches 20, 22 on the legs 6-8 outside the parallel planes of the slots, turned in the direction of the center hole while the notches 19, 21 on the legs between the planes of the slots 7, 9 are turned in the direction from the center hole. The bending of the legs 6, 8 is further facilitated by the

arrangement of sectional weakenings 23 at the ends of the slots.

By means of the design of the plug with four legs which at the application in a board will be broken in four directions a more equal load of the hole edge will be achieved and, compared to known universal plugs, larger capacity to absorb withdrawal forces. Further the arrangement of the slots 13, 14 in two parallel planes and the outward sectional weakening 19 on the legs 7, 9 between the planes of the slots makes it possible to produce the plug by means of injection moulding in an injection tool having few parts moving in relation to each other.

## CLAIMS

1 Fastening device in the form of a plug (1) comprising  
5 a central longitudinal hole (2) for cooperation with a  
screw (3) or equivalent and intended to be arranged in a  
pre-drilled hole (15) in building components (16,18) of  
practically all types from board covered stud walls (18),  
brick walls or light concrete walls to casted concrete  
10 walls (16) which plug (1) comprises, in its fixed  
condition, an inner end portion (4) in the through hole (2)  
of which a thread is arranged or measures have been taken  
in order to facilitate thread cutting e.g. the arrangement  
of internal ridges (5), four legs (6-9) extending from the  
15 inner end portion (4) and an outer end portion (10) in  
which the legs (6-9) join and which comprises a stop flange  
(11) or equivalent for bearing on the edge of the hole,  
characterised in that the four legs (6-9) are separated by  
means of two slots, penetrating the plug (1), arranged in  
20 essentially parallel planes.

2 Fastening device according to claim 1 characterised in  
that, the legs (6-9) each has a thickness increasing from  
the two end portions (4,10) in the direction of a central  
25 portion in such a way that the leg portion, when the plug  
(1) is not mounted, is extending more in the transverse  
direction than the end portions (4,10) and that this leg  
portion, in the plugs fixed condition in a dead end hole  
(15), having nominal diameter, is squeezed together by the  
30 walls of the hole to the diameter of the end portions  
(4,10), creating a contraction in the axial hole (2) at  
which contraction the plug (1), when the cooperating screw  
is introduced, will expand until it bears on four sectors  
of the wall of the hole (15).



3 Fastening device according to claim 1 and 2  
characterised in that at the center portions of the four  
legs (6-9) sectional weakenings in the form of notches (19-  
22) are arranged, internal notches (20, 22) on the legs (6,  
5 8) outside the slots (13, 14) arranged in parallel planes  
and external notches (19, 21) on the legs (7, 9) between  
the planes of the slots.

## AMENDED CLAIMS

[received by the International Bureau on 8 May 1990 (08.05.90)  
original claims 1-3 replaced by amended claim 1 (1 page)]

1. Fastening device in the form of a plug (1) comprising  
5 a central longitudinal hole (2) for cooperation with a  
screw (3) or equivalent and intended to be arranged in a  
previously bored hole (15) in building components (16,18)  
of practically all types from board covered stud walls  
(18), brick walls or light concrete walls to casted  
10 concrete walls (16) which plug (1) comprises, when the plug  
is mounted, an inner end portion (4) in the penetrating  
hole (2) of which a thread is arranged or measures have  
been taken in order to facilitate thread cutting e.g. the  
arrangement of internal cams (5), four legs (6-9) starting  
15 from the inner end portion (4) and an outer end portion  
(10) in which the legs (6-9) join and which comprises a  
stop flange (11) or equivalent for bearing on the edge of  
the hole, characterised in that the four legs (6-9) are  
separated by means of two slots, penetrating the plug (1),  
20 arranged in essentially parallel planes, designed in such a  
way that they have an increasing width in the direction of  
the central part of the plug, that the legs (6-9) each has  
a thickness increasing from the two end portions (4,10) in  
the direction of a central portion in such a way that the  
25 leg portion, when the plug (1) is not mounted, is extending  
more in the transverse direction than the end portions  
(4,10) and that this leg portion, when the plug is mounted  
in a hole (15) with a bottom, having nominal diameter, is  
squeezed together by the walls of the hole to the diameter  
30 of the end portions (4,10), creating a contraction in the  
axial hole (2) at which contraction the plug (1), when the  
cooperating screw is introduced, will expand until it bears  
on four sectors of the wall of the hole (15).

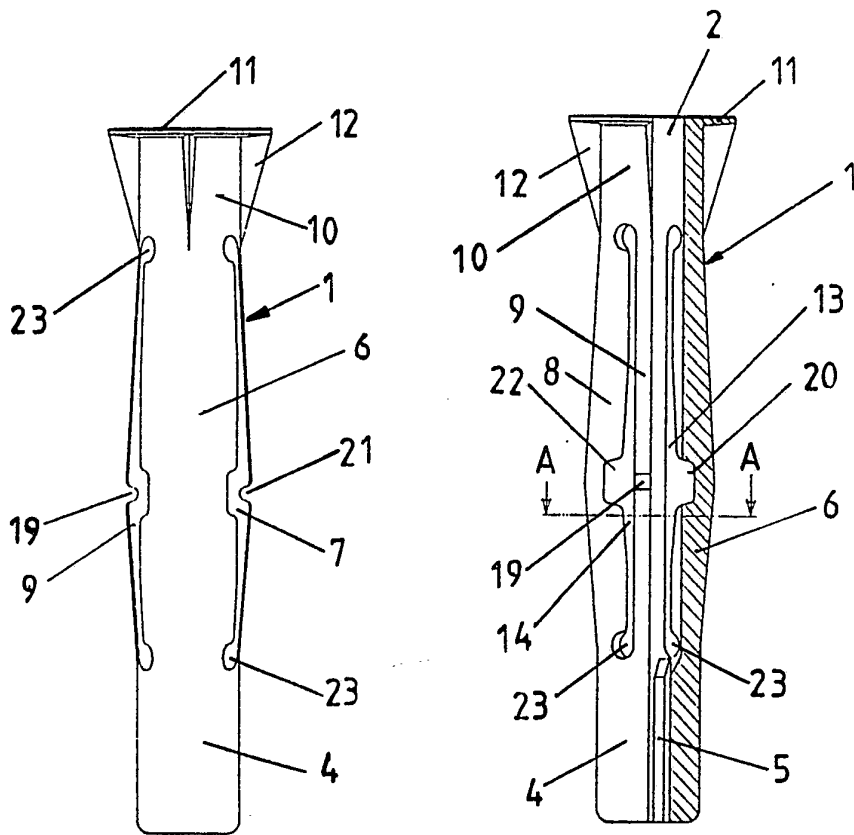


FIG. 1

FIG. 2

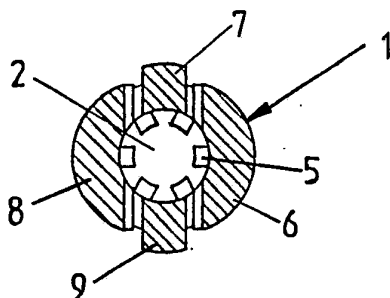


FIG. 3

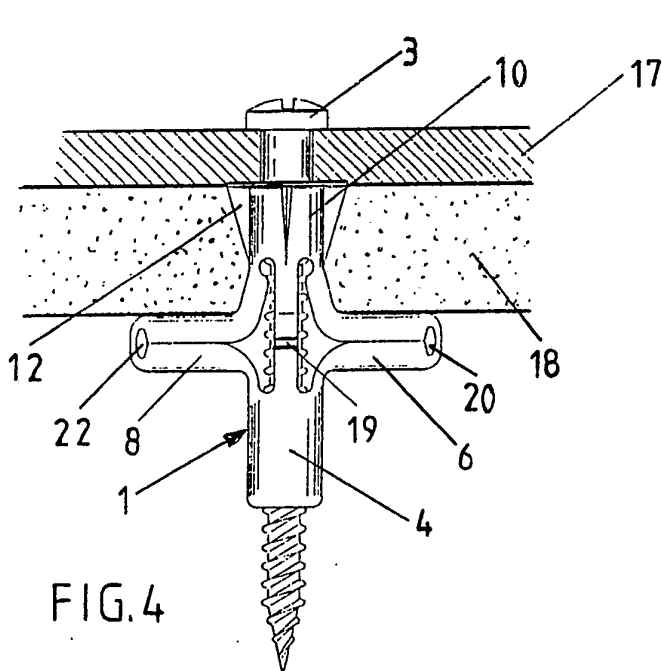


FIG. 4

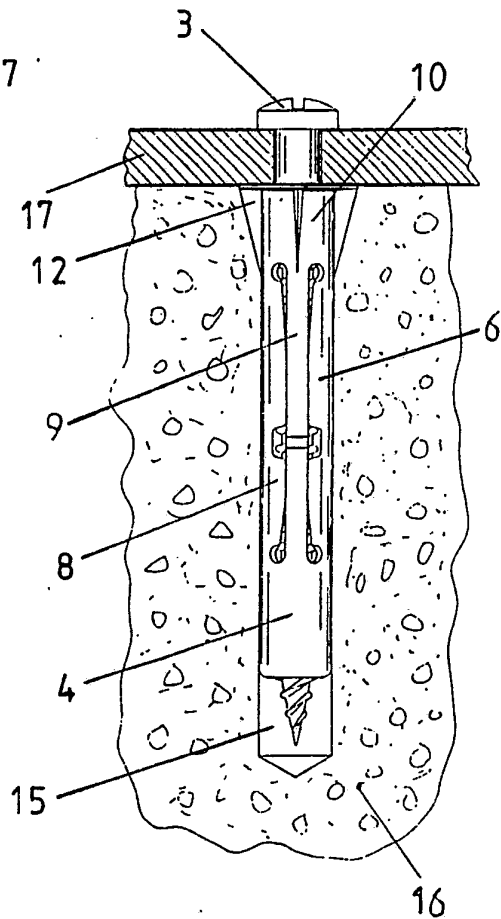


FIG. 6

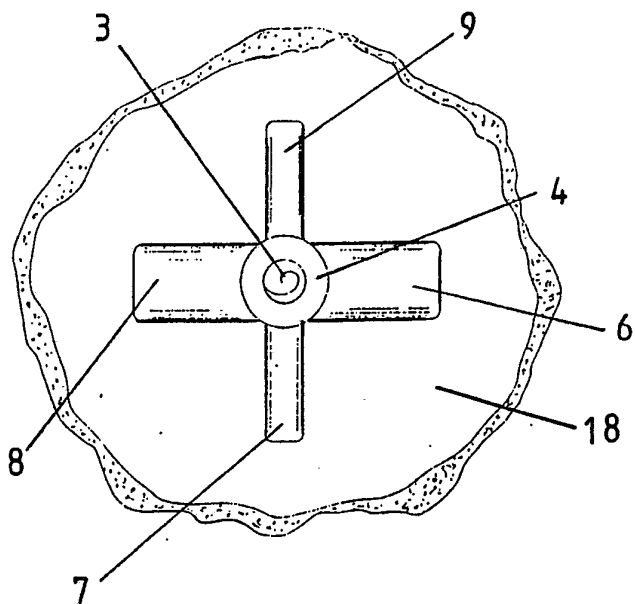


FIG. 5

# INTERNATIONAL SEARCH REPORT

International Application No. **PCT/SE 90/00009**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) *				
According to International Patent Classification (IPC) or to both National Classification and IPC				
<b>IPC5: F 16 B 13/06, 13/14, E 04 B 1/48</b>				
<b>II. FIELDS SEARCHED</b>				
(Mention the documentation searched)				
Classification of IPC	Classification of IPC			
IPC5	F 16 B; E 04 B			
(Mention also searched other than in the IPC classification the prior art which was taken into account in the fields searched *)				
<b>SE,DK,FI,NO classes as above</b>				
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> †				
Category ††	Citation of Document, †† with indication, where appropriate, of the relevant passages †‡	Relevant to Claim No. †‡		
X	SE, B, 415055 (A BERNER) 1 September 1980, see the whole document --	1		
A	EP, A1, 0092833 (HILTI AKTIENGESELLSCHAFT) 2 November 1983, see the whole document --	2		
A	EP, A2, 0169335 (ARTUR FISCHER FORSCHUNG) 29 January 1986, see the whole document --	1,2,3		
A	DE, C2, 2328385 (EATON CORP.) 20 December 1973, see the whole document --	1		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;">                 * Special categories of cited documents: --                  "A" document defining the general state of the art which is not considered to be of particular relevance                  "E" earlier document but published on or after the international filing date                  "L" document which may form a basis for priority claims or which is cited to establish the priority of a state or another citation of other special reasons (see 2.2.1)                  "O" document referring to an oral procedure, exhibition or other means                  "B" document published after the international filing date but prior to the priority date (Article 8)             </td> <td style="width: 50%; border: none; vertical-align: top;">                 † Later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention                  †† Document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step                  †‡ Document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art                  ††† Document number of the same patent family             </td> </tr> </table>			* Special categories of cited documents: -- "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may form a basis for priority claims or which is cited to establish the priority of a state or another citation of other special reasons (see 2.2.1) "O" document referring to an oral procedure, exhibition or other means "B" document published after the international filing date but prior to the priority date (Article 8)	† Later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention †† Document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step †‡ Document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art ††† Document number of the same patent family
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<b>IV. CERTIFICATION</b>				
Date of the International Search Report	International Search Report			
<b>28th March 1990</b>	<b>1990-04-05</b>			
International Searching Authority	International Searching Officer Marianne Dickman			
<b>SWEDISH PATENT OFFICE</b>				

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category*	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 4274324 (GIANNUZZI) 23 June 1981, see figures 14,17,18 -- -----	2

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO. PCT/SE 90/00009**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		BE-A- 849800	77-04-15
		CA-A- 1062517	79-09-18
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		FR-A-B- 2423669	79-11-16
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