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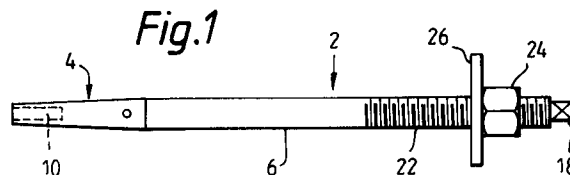
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(54) **Improvements in and relating to bolts.**

(57) A bolt (2) of the type having one end formed with a threaded hole and a second end formed with an external thread (22), which is known as a "she bolt", is described, together with a method of forming such a bolt (2). The method consists of the steps of tapping a threaded hole through the length of a first rod (4), forming an external thread (22) on at least a first end of a second rod (6), and connecting the two rods by screwing the first end of the second rod (6) into the internal threaded hole of the first rod (4). The end of the hole of the first rod (4) to which the second rod (6) is connected is double tapped to form a second, finer pitch, thread (12) therein. The threads are arranged so that removal of the bolt from a part to which the second, free, end of the first rod is screwed causes tightening of the screw connection between the two rods.

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This invention relates to bolts employed in formwork and in particular to bolts employed to connect a structural formwork member to a rod.

One type of bolt which is commonly used in formwork has a first end formed with an internal threaded hole and a second end formed with an external thread. The bolt can be passed through a structural member and be secured at its first end to a rod which is threaded along its length, or at least at its ends, by screwing an end of the rod into the first end of the bolt. A nut can be mounted on the second end of the bolt to hold it in the structural member. If the free end of the rod is secured, for example, connected to another such bolt positioned through a second structural member, then the first structural member can be pulled towards the rod by tightening up the nut.

One common usage of such a bolt is in the production of walls. The panels, between which the wall is to be cast, are supported by beams, a rod being mounted between the beams by use of two bolts of the type described above which are passed through the beams and the panels. The nuts are tightened to pull the panels hard towards each other to resist the forces experienced as the wall is formed. When the wall is set, the bolts are withdrawn by unscrewing them from the rod which is left within the wall. The small holes left by the first ends of the bolts can be filled.

This type of bolt is commonly known as a "she bolt".

One known method of forming a she bolt is simply to blind tap a threaded hole in one end of a section of rod and tap an external thread into the other end. The problem with this method is that blind tapping only allows production of small pitch threads on the internal hole. Thus she bolts formed by this method cannot be employed with large pitch threaded rods.

Accordingly, alternative methods of she bolt formation have been proposed which do permit the formation of an internal hole with large pitch threads. In one suggested method, a thread is tapped through the whole length of a piece of rod and one end of the rod is then attached to an externally threaded second rod. The rods are connected by crimping an end of the first rod around an end of the second rod as welding damages the second rod. The disadvantage of this is that the crimped connection is not strong and there is a tendency for the bolt to break, i.e., separate into two parts, particularly on withdrawal of the bolt in methods of the type described above. Furthermore, even if the connection does not actually fail, threads form on the crimped portion of the first rod as a result of the crimping thereof around the end of the second, externally threaded, rod. The result of this is that, when the bolt is withdrawn by

unscrewing it from the centre rod, the two parts of the bolt have a tendency to unscrew from each other. Accordingly the internally threaded first rod is left in the wall and has to be manually removed therefrom which produces a large hole which must be made good.

In an alternative suggested method, two rods are prepared in the same way as in the first suggested method but are connected by friction welding. The problem with this is that it has been found that whilst the connection is stronger than that produced by crimping, there is still a tendency for the two rods to separate on withdrawal of the she bolt.

Despite many efforts, no satisfactory method of forming a she bolt for use with threaded rods with a large pitch thread has been found.

In accordance with the invention a method of forming a bolt of the type having a first end formed with a threaded hole and a second end formed with an external thread comprises forming a hole through the length of a first rod, tapping the hole with a first thread, double tapping a first end of the hole to form a second thread therein, forming an external third thread on at least a first end portion of a second rod and connecting the rods by screwing the first end portion of the second rod into a first end of the threaded hole of the first rod, the hand of the threads on the rods being so arranged that unscrewing of the second end of the threaded hole of the first rod from a member to which the bolt is attached will tend to tighten up the connection between the two rods.

A bolt formed by this method is capable of use with any type of threaded rod no matter what the pitch of the threads is. Furthermore it will not separate into its two constituent parts when withdrawn from the edges of a wall. Instead, the connection between the two parts will be tightened by withdrawal of the bolt. The bolt has been found to work extremely well in practice.

The second end of the second rod may be formed with a fourth thread, the pitch of the fourth being larger than that of the third.

The hand of the fourth thread may be the same as that of the first thread.

Preferably the first rod is tapered from the end connected to the second rod to the free end thereof. This facilitates removal of the bolt from a formwork arrangement. The end portion of the second rod may also be tapered to give a longer "nose" and further facilitate removal of the bolt.

Suitably the extreme end of the threaded end of the second rod is machined into a square to provide a grip surface for a spanner, again to facilitate removal of the bolt from a formwork arrangement.

The invention will now be further described by way of example with reference to the accompanying drawings in which: –

Figure 1 is a side view of a bolt in accordance with the invention; and

Figure 2 is a side view of the first part of the bolt of Figure 1;

Figure 3 is a side view of the second part of the bolt of Figure 1; and

Figure 4 is a schematic view of a formwork arrangement employing a pair of bolts as shown in Figure 1.

The bolt 2 comprises two interconnected parts 4 and 6 each of which basically comprises a rod. The rod 4 is tapered from the end connected to the rod 6 to its free end and has an internal hole 8 which extends through the length thereof. The hole 8 is threaded, the thread 10 at the free end of the rod 4 being a large pitch thread, for example, a Dividag thread, and the thread 12 at the connected end of the rod 4 being a small pitch thread of the opposite hand to the thread 10.

The rod 6 consists of three sections 14, 16 and 18. The first section 14 has a diameter approximately equal to that of hole 8 and is formed with an external thread 20 of the same pitch and hand as the internal thread 12 at the connected end of the rod 4. The second section 16 has a diameter equal to that of the connected end of the rod 4 and is formed with an external thread 22 whose pitch is greater than, and of opposite hand to, thread 20. The thread 22 extends along the section 16 from the free end of the rod 6 for a portion of the length thereof. The third section 18 is at the extremity of the free end of rod 6 and is machined to form a square whereby it may be gripped by a spanner.

A hexagonal nut 24 is provided for the bolt 2 and a waler plate 26 may also be screwed onto the threaded end of the second rod 6.

The bolt 2 is manufactured by, firstly, drilling the hole 8 along the length of rod 4. The large pitch thread 10 is then tapped along the whole length of the hole 8. The hole 8, at the end of the rod 4 which will be connected to the second rod 6, is then re-tapped with finer pitch thread 12.

A second rod is then appropriately turned and machined to give the three sections 14, 16 and 18 whereafter external thread 20, of the same pitch and hand, to internal thread 12, is formed on the first portion 14 and external thread 22, which may be relatively coarse, is formed on the second portion 16.

The two rods are then connected by screwing the portion 14 of rod 6 into the end of hole 8 with fine pitch thread 12.

The assembled unit may then be machined to taper the bolt from the free end of rod 4. The rod 4 may solely be tapered or, to provide a longer nose,

the rod 4 and part of the rod 6 can be tapered. Alternatively, this tapering can be carried out as part of the original preparation of the rods 4 and 6 prior to their connection.

It will be appreciated that both rods 4 and 6 can be prepared completely separately and no further operations have to be carried on the bolt 2 once this is formed by screwing the two rods 4 and 6 together. The two-part form of the bolt 2 makes it possible to provide the large pitch internal thread 10 since this is formed by tapping along a complete hole rather than having to blind tap a hole, the latter operation with a large pitch thread being very difficult, if not impossible.

Figure 4 illustrates one use of the bolt 2. In this arrangement a wall is to be formed in the region 28 between two panels 30, each panel being supported by structural members 32, for example soldiers, and bracing members 34. A bolt 2 is passed through each structural member 32 and its associated panel 30 and a threaded rod 36 is connected between the bolts 2 by screwing its ends into free ends of the bolts 2. The connection is tightened up by turning the nuts 24 on the bolts 2 which forces the waler plates 26 hard against the structural members 30 and thus pulls the structural members 34 closer together. Concrete or other building material is then filled into the region 28 around the rod 36. Once this is set, the bolts 2 are withdrawn by applying a spanner to their square ends 18 and turning this to cause the bolts 2 to unscrew from the rod 36. This also tightens the screw connections between the rods 4 and 6 of the bolts 2 due to the hand of the threads 10, 12 and 20 so that the whole bolt 2 is removed. The rod 36 is left in the wall and the small holes produced in the wall as a result of the tapered bolt heads can be filled in.

The bolt 2 can be employed with any rod, no matter what the pitch of the thread is on it, the method of manufacture allowing production of a bolt with any required size internal hole thread. It is strong and does not break on withdrawal from a wall or other structure.

Claims

1. A method of forming a bolt of the type having a first end formed with a threaded hole and a second end formed with an external thread comprising forming a hole through the length of a first rod, tapping the hole with a first thread, double tapping a first end of the hole to form a second thread therein, forming an external third thread on at least a first end portion of a second rod and connecting the rods by screwing the first end portion of the second rod into a first end of the threaded hole of the

first rod, the hand of the threads on the rods being so arranged that unscrewing of the second end of the threaded hole of the first rod from a member to which the bolt is attached will tend to tighten up the connection between the two rods. 5

2. A method as claimed in Claim 1 wherein a second end portion of the second rod, at the opposite end to the first end portion thereof, is formed with an external, fourth, thread. 10
3. A method as claimed in Claim 2 wherein the first and fourth threads have the same hand. 15
4. A method as claimed in any preceding Claim wherein the second and third threads are fine pitch threads.
5. A method as claimed in any preceding Claim wherein the first thread is a Dividag thread. 20
6. A bolt formed by a method as claimed in any one of Claims 1 to 5 wherein the second rod comprises three sections; a first section consisting of the first end portion, a second section including the second end portion and having a diameter equal to that of the first rod at the first end thereof, and a third section forming the extreme second end of the second rod and having a square cross-section. 25 30
7. A bolt as claimed in Claim 6 wherein the first rod is tapered from the first to the second end thereof. 35

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Fig.1

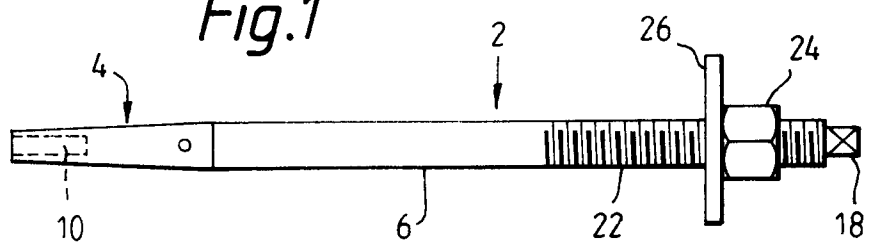


Fig.2

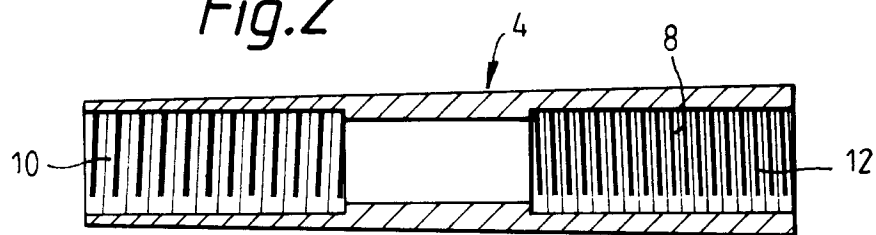


Fig.3

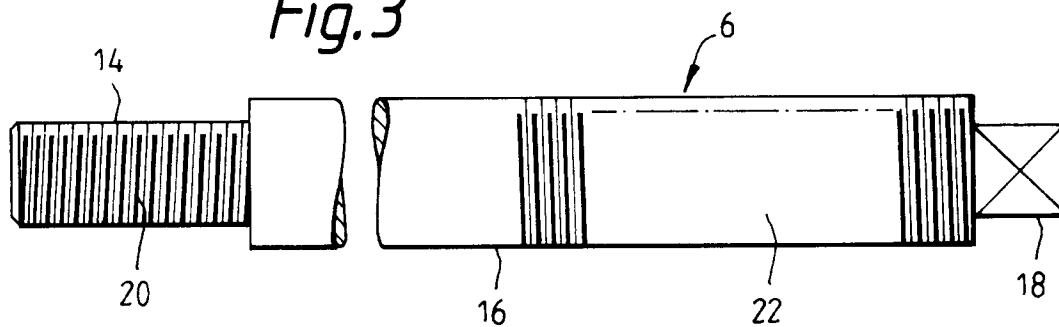
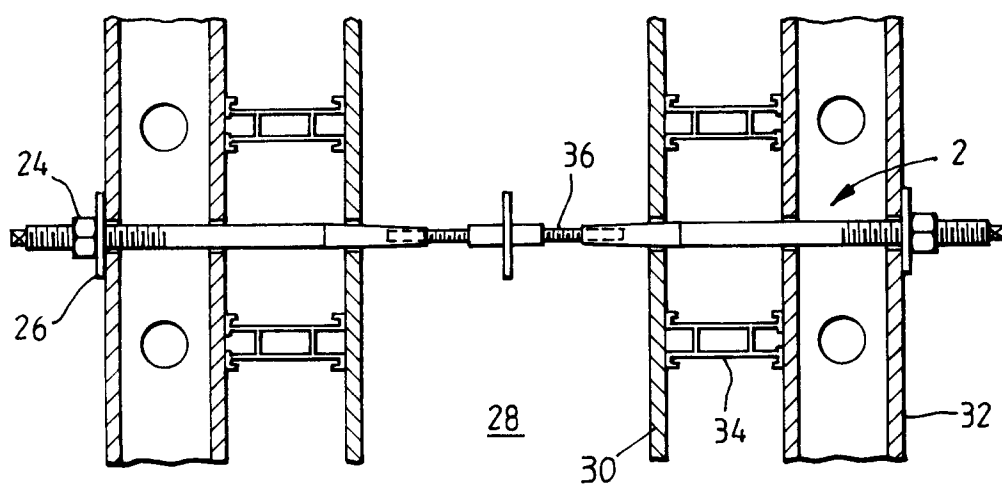


Fig.4





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EUROPEAN SEARCH REPORT

Application Number

EP 91 31 0397

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-1 938 153 (L. A. REEVES) * page 1, line 93 - page 2, line 3; claims; figures *	1,2	E04G17/06 F16B35/00
Y	---	6,7	
Y	US-A-3 613 216 (C. I. WILLIAMS) * column 4, line 23 - line 39; figure 15 * -----	6,7	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E04G F16B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29 JUNE 1992	Examiner PLASTIRAS D.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			