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(71) Applicant: **FLOWDRILLING LIMITED**
The Hollygate
Chestergate Stockport SK3 ORD(GB)

(72) Inventor: **Walker, Robert**
19 Thorn Grove
Cheadle Hulme, Cheshire(GB)
Inventor: **Overy, Keith Harry**
5 Tyburn Lane
Pullax-Hill Bedfordshire(GB)
Inventor: **Fogg, Paul**
19 Newlyn Avenue
Congleton, Cheshire(GB)

(74) Representative: **Barker, Rosemary Anne et al**
c/o O'BRIENS 94 Market Street
Manchester M1 1PJ(GB)

(54) A method of making an angled joint.

(57) A method of making a rigid angled joint between a first length 12 of metal tubing and a second length 18 comprises the steps of first applying a rotating piercing tool (not shown) under pressure, to the first tube's wall. The tool thus forms a hole 14 surrounded by an integral bush 16 which is formed from the displaced tube wall material, is at an angle to the axis of the tube 12 and has a diameter to closely fit the external diameter of the second tube 18. The second tube 18 is inserted through the bush 16 into the interior of the first tube 12 and is secured therein by, preferably a bolt or screw (not shown) extending through a second smaller concentric hole 26 and locating in threaded extension 22 of the second tube 18.

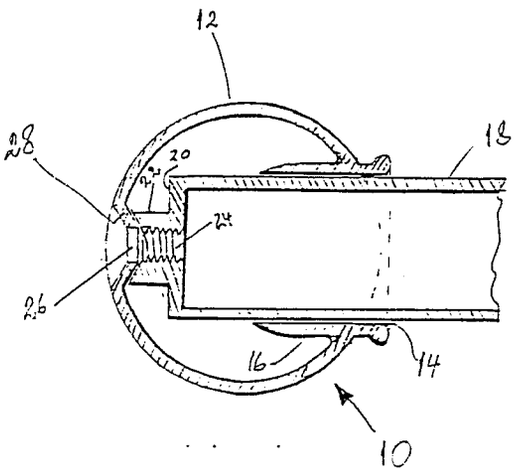

Fig.1

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A METHOD OF MAKING AN ANGLED JOINT

This invention relates to a method of making rigid angled joints between a first length of metal tube and a second length which is a round tube or rod especially for the construction of a tubular framework.

It is known to construct rigid frames made of metal tubes which can be assembled and again disassembled for ease of storage and transport to support such objects as exhibition display stands or camping tents or pieces of furniture or office storage racks to name a few. It is usual to make the angled joints in such frames by using special clamping devices or by the use of cleats or brackets welded to one or both of the tubes and joining these with the aid of bolts and nuts or by a wedging action.

It is an object of the present invention to provide a method of making an angled joint between two lengths of metal tubing which is a rigid non-yielding connection of great strength but can permit the tubes to be easily separated when so required. It can also be arranged to show only the head of one screw as the fastening aid.

With this object in mind the present invention provides a method of making an angled joint between a tubular metal first member and a second member of round tubular or rod form comprising the step of applying a rotating piercing tool, under pressure, to the tube wall of the first member to form with the aid of friction generated heat a hole in that wall surrounded by an integral annular bush at an angle to the axis of the member, the bush having a length greater than the tubular wall thickness of the member and a diameter to closely fit the external diameter of the round second member, inserting the end of the second member through the closely fitting bush into the interior of the first member and removably anchoring it therein.

Preferably the method includes a further step of making a smaller hole concentric with the bush in the opposing wall of the first member and providing an internal thread at the end of the second member, for a bolt or screw to extend through the smaller hole into the thread at the end of the second member thus anchoring the second member securely to the first.

The process of forming a hole with the aid of friction generated heat by applying a rotating piercing tool is known as flowdrilling and preferably it is performed in such a way that the annular bush in the wall of the first member projects both inwardly and outwardly therefrom to provide support for the inserted second member. The amount of outward projection may be made fairly small dependent on the shape of the rotating piercing tool. The cross section of the first member may be circular, oval, square, rectangular or even polygonal provided it has one internal dimension larger than the external diameter of the second member to accommodate the latter with the surrounding bush.

The small concentric hole in the first member may be plain or also formed, e.g. by flowdrilling with an integral surrounding bush for added strength or plain in the centre of a conical indentation to accept a countersunk head of the screw.

The second member of round cross-section may be tubular also or may be a solid round rod where this is advantageous such as in very small frameworks to support, for instance shop display stands for watches or jewellery.

A second aspect of the invention provides a construction comprising a tubular metal first member jointed to a second member of round tubular or rod form, the axes of the members at the joint extending transversely to each other, the joint comprising a hole in the tubular wall of the first member and an annular bush integrally formed of the wall material surrounding said hole, the second member extending into said bush which has a length greater than the wall thickness of the first member and a diameter closely fitting the inserted second member and easily removable anchoring means securing the second member in the bush.

Preferably the second member has a threaded hole receiving a bolt or screw passing through the tube wall of the first member to secure the second member in the bush

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

Fig. 1 is a sectional end view of a part assembled preferred embodiment of the joint according to the invention;

Figs. 2, 3 and 4 are simplified part sectional end views showing the formation of the hole and integral bush according to the invention; and

Fig. 5 is a part sectional perspective view of an assembled joint.

Figure 1 illustrates a preferred embodiment of a joint constructed according to the method of the invention and is referred to generally by the reference numeral 10. A first length of round metal tubing 12 has a hole 14 with an integral bush 16.

The internal diameter of hole 14 corresponds closely to the external diameter of a second metal tube 18 which is therefore a friction fit when inserted therein.

Tube 18 is extended by a concentric tube of smaller diameter 22 secured to one end 20 of the tube 18. The wall of the tube 22 has an internal

screw thread 24. A second hole 26 is formed in a conical indentation 28 in tube 12 disposed opposite and concentric with hole 14 and having a smaller internal diameter to correspond with the size of thread 24.

Figs. 2, 3 and 4 illustrate the forming of the hole 14 and bush 16 by a process known as flowdrilling. A rotatable piercing tool 30, rotating at high speed, is applied with an axially directed pressure to the first tubular member 12. The piercing tool 30 is preferably of tungsten carbide and its shape determines the configuration of the annular bush 16. Forms of piercing tools suitable for forming the required hole 14 and their respective bushed holes are described in British Patents Nos. 1455276, 2091610, and 2144665.

The application of the tool 30 to the tube wall causes the generation of local heat, about 850° c where the tube wall is of mild steel, and this causes the tube wall in contact with the tool 30 to behave as a plastic with the tube wall material flowing up and down the tool 30 forming the integral bush 16. The bush 16 thus formed usually has a total height of about three to ten times the tube wall's thickness and the enclosed hole is truly circular in cross-section and can be made of close tolerance in size. After the bush has been formed the piercing tool 30 is withdrawn from the hole 14.

The second metal tube 18 is inserted through the bush 16 until the extending tube 22 locates against the conical indentation 28 in the opposite tube wall as shown in Fig. 1. A screw or bolt 32 is inserted through hole 26 engaging with the thread 24 to pull the extending tube 22 to firmly abut the inside of the indentation 28 of the tube 12 which thereby is firmly locked to tube 18. A joint thus formed is rigid and mechanically strong.

It will be appreciated that such a joint is readily applicable to tubular steel furniture and would allow such pieces of furniture to be stored or transported unassembled. Assembly could then be easily undertaken at the actual site of installation.

Furthermore it would be possible to assemble varying sizes of, for example, tables using a variety of basic component parts. Other uses for such a joint include exhibition display stands, tent or other temporary structures, office storage racks etc.

The invention is not confined to the foregoing details and variations may be made thereto. For example, it is not required to have the first tube 12 of circular cross-section as it would be possible to form a joint according to the invention on a metal tube having a square cross-section. Other cross-sectional shapes for example, triangular, oval, rectangular or polygonal may also be utilised. Variations may be made to the means by which the second tube 18 is secured to the first 12 and consequently the concial indentation 28 may be omitted or disposed together with the second hole 26 elsewhere in relation to the tubes. Other means for securing the tube include the use of a pin or bolt projecting diametrically through the first tube walls and thence through the portion at the second tube 18 received inside the first tube. Although the joint described is a right angled joint a joint whereby the second tube is disposed at more or less than 90° to the first tube is also possible. Other variations may also be possible.

Claims

1. A method of making an angled joint (10) between a tubular metal first member (12) and a second member (18) of round tubular or rod form comprising the steps of applying a rotating piercing tool, under pressure, to the tube wall of the first member (12) to form, with the aid of friction generated heat, a hole (14) in that wall surrounded by an integral annular bush (16) at an angle to the axis of the member (12) the bush being a length greater than the tubular wall thickness of the member and a diameter to closely fit the external diameter of the round second, member (18), inserting the end of the second member (18) through the closely fitting bush (16) into the interior of the first member and removably anchoring it therein.

2. A method of making an angled joint as claimed in claim 1 including the further steps of making a smaller hole (26) in the tubular first member (12) in an opposing wall to the bush (16) and concentric with the bush (16) and providing an internal thread (24) at the end of the second member (18), for a bolt or screw to extend through the smaller hole (26) into the thread (24) at the end of the second member.

3. A method of making an angled joint as claimed in claim 2 wherein the step of making the smaller hole (26) comprises applying a rotating piercing tool, under pressure, to the wall of the first member (12) to form with the aid of friction generated heat the hole (26) surrounded by a respective integral annular bush.

4. A method of making an angled joint as claimed in any one of claims 1, 2 or 3 wherein the second member is a solid round rod.

5. A construction comprising a tubular metal first member (12) jointed to a second member (18) of round tubular or rod form, the axes of the members at the joint extending transversely to each other, the joint comprising a hole (14) in the tubular wall of the first member (12) and an annular bush (16) integrally formed of the wall material surrounding said hole, the second member (18) extending into said bush (16) which has a length greater than the wall thickness of the first member

(12) and a diameter closely fitting the inserted second member (18) and removable anchoring means securing the second member (18) in the bush.

6. A construction according to claim 5 wherein the second member (18) has a threaded hole (24) receiving a bolt or screw passing through the tube wall of the first member (12) to secure the second member (18) in the bush (16)

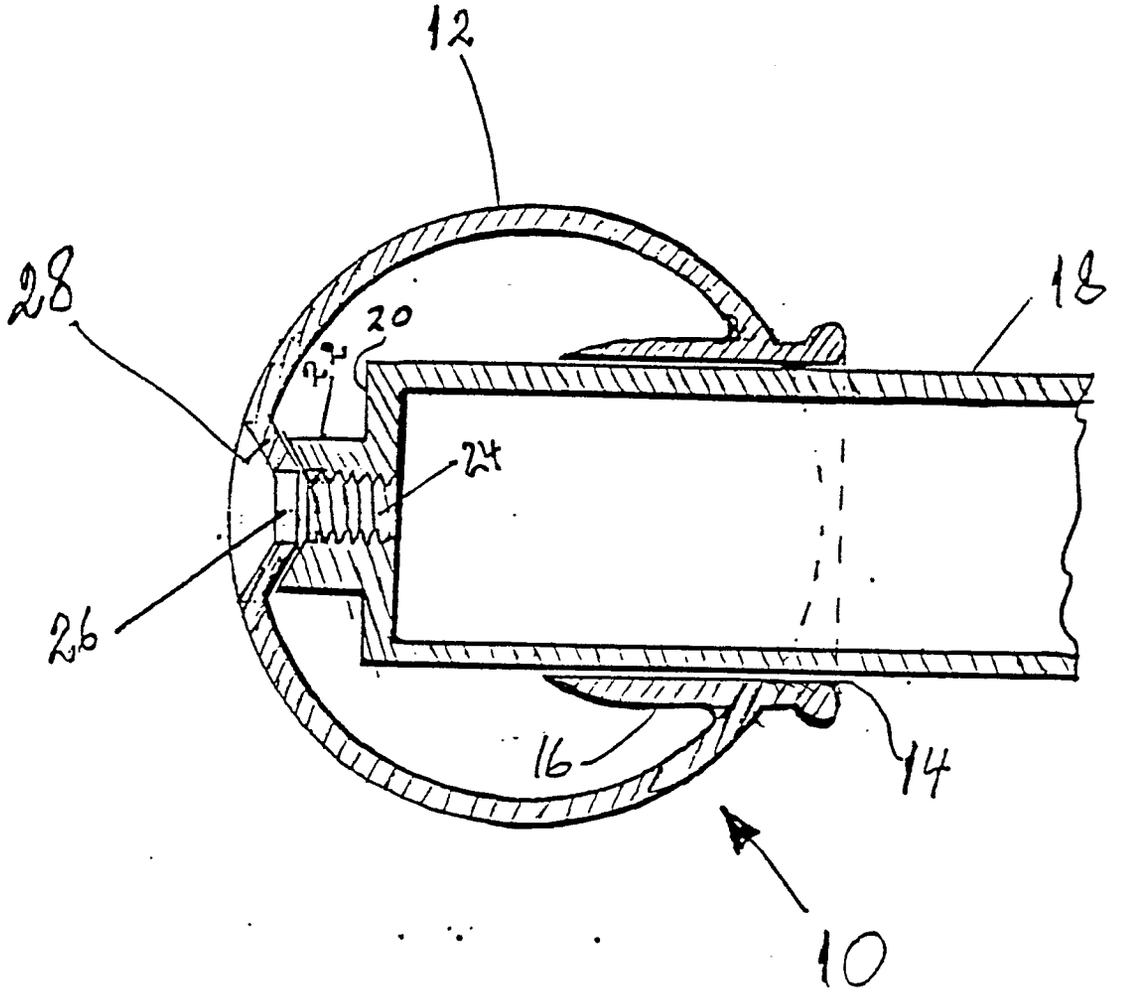

Fig. 1

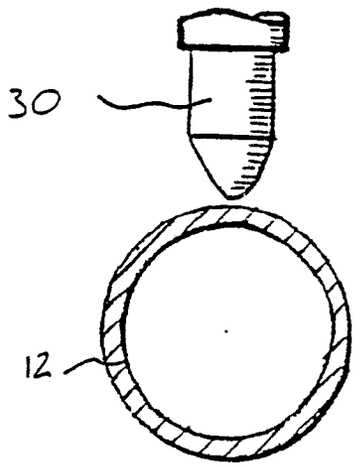

Fig.2

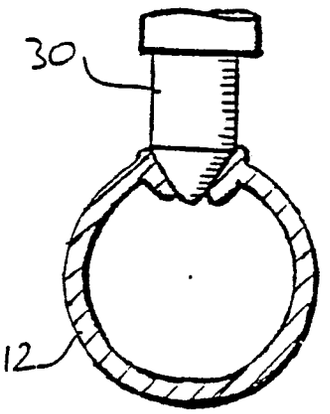

Fig.3

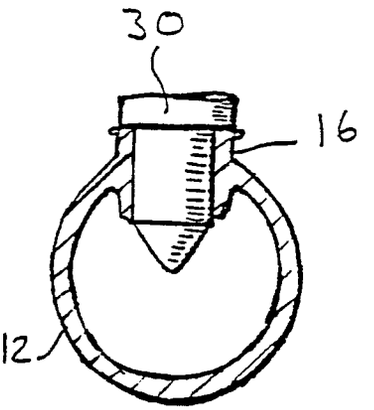

Fig.4

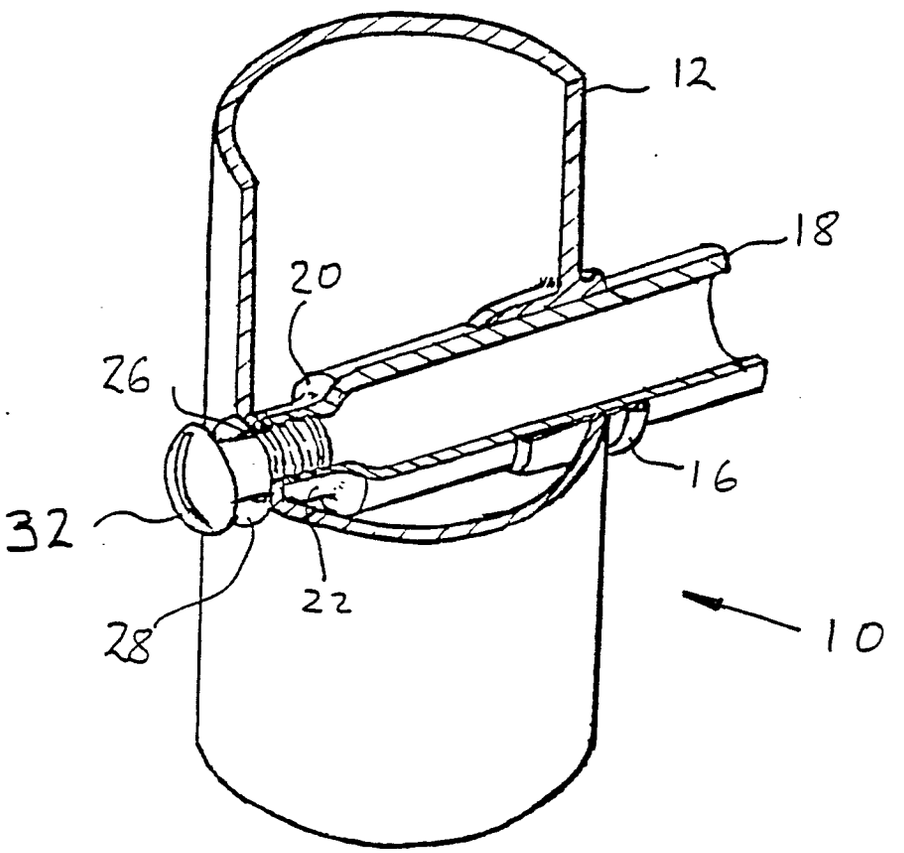

Fig.5