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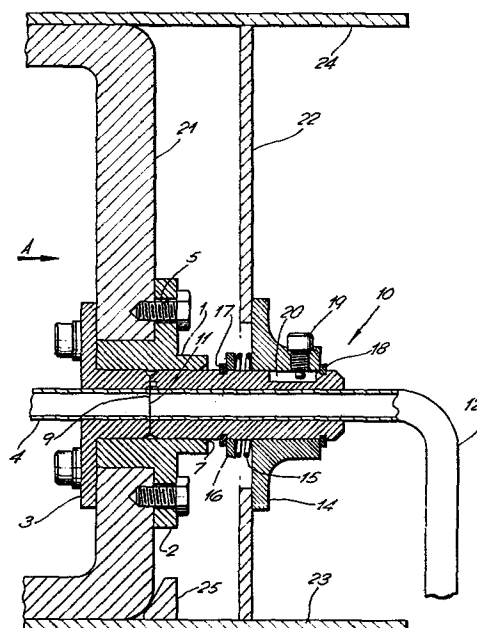
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54 **Waveguide connection arrangements.**

57 A two-part slidably detachable waveguide connector, particularly for a radar system, is provided on one part with a slidable first outwardly spring biased waveguide portion (10), on the other part with a second mating waveguide portion (3) and on either part with a tubular guide (1) which relatively locates the waveguide portions and surrounds their mating interface (9, 11) when they are attached. One of the waveguide connector parts may be mounted on the rear of rack-mounted radar equipment (21) and the other part in a corresponding position on the rack (22), so that the parts may be rapidly engaged or disengaged by merely sliding the equipment into or out of the rack.



The present invention relates to the connection and disconnection of waveguides and is particularly concerned with microwave interfaces on items of equipment which need to be rapidly connected and disconnected, such as radar and other military equipment.

Hitherto, detachable waveguide connections have generally been made by bolting together flanged mating surfaces of the waveguides. This procedure which generally involves the tightening or untightening of a number of nuts and bolts, is time consuming and awkward, particularly when the connection is not easily accessible. However, it has hitherto been believed that a tight bolted flange connection is necessary in order to ensure low power losses at the mating interface and to ensure that dirt and moisture are excluded.

U.S. patent specification No.2,928,059 discloses a two-part waveguide coupling comprising two mating flanges incorporating respective registering waveguide sections. When mated, the flanges are relatively located in the lateral direction by short dowel pins projecting from one flange into corresponding apertures in the other. When separated, one flange is rigidly supported and the other is weakly held on a resilient pad against the outside of a wall of an equipment casing by the cantilever action of a U-shaped continuation of its associated waveguide, which extends from inside said casing to the flange through a large aperture in said wall. This flange and its associated pad therefore has limited sliding freedom of movement over the outside of said wall, and is also tilted outwards in one edge by its associated supporting U-section of waveguide. As they are brought together, the flanges are initially aligned by tapered and counterwunk portions of the dowel ends and associated apertures respectively; the outwardly tilting flange is then forced back against the cantilever action of the U-section of waveguide until it is parallel with the other flange and then the mating faces of the flanges abut one another and are resiliently held together by the react-

ive force of the resilient pad and the U-section of waveguide. However, the angular deflection of the pad-mounted flange (which is not constrained to slide in the axial direction) and the direction of the reactive force of the associated U-section of waveguide (which is in general non-perpendicular to the flange interface) ensure that the compressive force holding the faces of the flanges together generally varies around their circumference. Accordingly severe problems in flange face abutment are liable to arise, with consequent microwave losses at the flange interface. The dowel pins (which are necessarily short in view of the initial angular misalignment of the flange) do not provide any appreciable angular alignment of the flanges sufficient to even out the abutment force around the circumference of the mating interface.

We have found that such problems can be substantially overcome by a novel connector arrangement which does not employ a tightly locked mating interface.

According to the present invention a two-part slidably detachable waveguide connector provided on one part with a first waveguide portion biased away from said part by spring means and on the other part with a second waveguide portion arranged to mate with said first waveguide portion is characterised in that said first waveguide portion is mounted for sliding movement in the axial direction on said one part and in that a tubular outer sleeve is provided on either part, which sleeve slidably locates said portions and surrounds their mating interface when the connector parts are attached.

The axial alignment provided by the outer sleeve ensures that the abutment force acts evenly on the mating waveguide sections. Furthermore the outer sleeve electrically reduces power losses to a surprising extent by its presence around the mating interface.

Said connector may be incorporated in an arrangement further comprising guide means distinct from said connector which in use slidably locate the connector parts and align

them when they are separated. Thus one of the waveguide connector parts may be mounted on the rear of the casing on a piece of equipment arranged to be rack-mounted and the other waveguide connector part is then mounted at a
5 corresponding position on the rack, so that the connector parts can be mated simply by sliding the equipment into the rack and held in position by frictional engagement between the equipment and the rack. Any slight initial mismatch in the positions or orientations of the connector parts may be
10 accommodated by providing an alignment taper on the engaging surfaces of either or both of the connector parts. However the waveguide portions should be a close sliding fit in the outer sleeve in order to ensure that their mating faces accurately abut one another, and thereby ensure low electrical losses at the interface. Normally any strain on the
15 connector will be taken by the flexible casing of the equipment or the rack.

The invention is however also applicable to multiple bayonet connectors as used in military applications, for
20 example.

Preferably the outwardly biased waveguide portion is mounted on one (male) part of the connector and the tubular guide is incorporated in the other (female) part of the connector. The connector may incorporate a shutter over the
25 recessed mating surface of the female part of the connector which is opened by a coarse alignment pin on the male connector part when the parts are brought together.

One of the mating surfaces (which are preferably planar) may be provided with a groove surrounding the inner
30 surface of the waveguide. The groove acts as a waveguide choke at the connector interface and thereby reduces the mismatch in impedance between the connector parts (which is inherent in all waveguide and transmission line discontinuities) and hence any power losses which might otherwise
35 occur.

In most cases the lengths of waveguide connected by the connector will be rectangular in cross section and will need to be rotationally aligned about their common axis. One length of waveguide may be gripped within the
5 tubular guide and the tubular outer sleeve (which may suitably be circular in cross-section) in turn may be aligned by means of a pin mounted on the body of the associated

connector part which engages an axial slot in its surface. The bodies of the connector parts may be relatively aligned by means of a dowel pin projecting from one body into a hole in the other.

5 Embodiments of the invention will now be described by way of example with reference to Figures 1 to 7 of the accompanying drawings, of which:

 Figure 1 is an axial sectional elevation of one part of a connector for use in an arrangement in
10 accordance with the invention;

 Figure 2 is a plan view taken on Figure 1;

 Figure 3 is an axial sectional elevation of another connector part suitable for fitting to that shown in Figures 1 and 2;

15 Figure 4 is a plan view taken on Figure 3;

 Figure 5 is a sectional elevation showing the connector parts of Figures 1 to 4 in a schematic arrangement in accordance with the invention, and

20 Figure 6a is an axial section of one part of a bayonet connector for use in an arrangement in accordance with the invention,

 Figure 6b is an axial section of a corresponding connector part aligned with the connector part of
25 Figure 6a, and

 Figure 7 is an axial section showing the connector parts of Figures 6a and 6b locked together. Similar parts are indicated by corresponding reference numerals throughout the drawings.

30 Referring first to Figures 1 and 2, the connector part shown comprises a guide tube 1 integral with a supporting flange 2 and a tubular insert member 3 which is a sliding fit in the guide tube. A rectangular section waveguide 4 is brazed to the inner wall of insert member 3
35 so as to lie flush with a flat mating surface 9 of the latter. Supporting flange 2 is provided with four holes

5 and tubular insert member 3 is similarly provided with four threaded holes 6 (Figure 2) on its flange portion so that the supporting flange 2 and tubular insert member 3 can be bolted to a common supporting plate (not shown) which is thus clamped between them. Guide tube 1 is provided with a tapered alignment surface 7 to enable the corresponding male part of the connector (shown in Figures 3 and 4) to be inserted into guide tube 1.

The corresponding male part of the connector comprises a tubular waveguide portion 10 (Figure 3) provided with a flat mating surface 11. A section of waveguide 12 is brazed to the inside wall of waveguide portion 10 and lies flush with surface 11. A tapered alignment surface 13 is provided on the perimeter of surface 11, enabling waveguide portion 10 to be slid into the guide portion 1 of the female connector part shown in Figures 1 and 2. Waveguide portion 10 is slidingly supported by a supporting flange 14 and biased outwardly by a spring 15 which acts on a ring 16 which is in turn held in place by a clip 17. Outward movement of waveguide portion 10 is limited by an annular stop 18, and a pin 19 projects into an axial slot 20 to ensure rotational alignment of waveguide portion 10 with flange 14.

Figure 5 shows an arrangement incorporating the connector parts of Figures 1, 2 and 3, 4 mounted on the rear of an equipment casing 21 and a vertical member 22 of a rack respectively. Shelves 23 and 24 of the rack co-operate with the casing 21 to guide the two parts of the connector into mating engagement as shown when the equipment is slid into the rack as indicated by arrow A, the extent of this travel being limited by one or more stops 25. Spring 15 acts against frictional engagement between casing 21 and shelf 23 to force mating surfaces 11 and 9 into close contact. Waveguide section 12 need not be particularly flexible but it should be long enough to allow

reasonable freedom of movement of waveguide portion 10 in the direction of arrow A. The connection may be broken simply by withdrawing the equipment from the rack in the opposite direction to arrow A. It will be

5 apparent that the invention includes within its scope similar arrangements in which mating surface 9 rather than mating surface 11 is outwardly spring biased or in which guide tube 1 is integral with waveguide portion 10 and co-operates with a male connector part mounted on
10 the equipment casing.

Figure 6a shows a connector part comprising a waveguide portion 10 slidably mounted within a guide tube 1. A rectangular section of waveguide 12 is fitted into waveguide portion 10 and is rotationally aligned
15 by a pin 19 which engages a longitudinal slot 20. A guide bushing 25 mounted via a carrier member 26 on guide tube 1 is a sliding fit around waveguide portion 10. A rotatable locking collar 27 is slidably mounted on a carrier 26 and is spring biased away from the direction of
20 engagement by means not shown. Waveguide portion 10 is provided with a flat mating surface 9 and is biased outwardly by a spring 15.

The corresponding connector part shown in Figure 6b is fixed to an equipment casing 21 (by means
25 not shown) and comprises a tube 28 within which is mounted a waveguide portion 10' from a flange 29. A rectangular waveguide section 12' runs to waveguide portion 10' from the interior of the equipment casing. Dowel pins 30 ensure rotational alignment of the wave-
30 guide portion 10 with tube 28.

The locking collar 27 is provided with a bayonet slot 31 and tube 28 is provided with a corresponding locking portion 32. The connector parts may be interlocked as shown in Figure 7 by rotating collar 27 to
35 align locking portion 28 with its bayonet slot 31 and then further rotating collar 27 to prevent withdrawal.

The connector parts are rotationally aligned relative to each other by longitudinal ribs (not shown) in carrier member 26 which engage in corresponding slots (not shown) in the inside surface of tube 28.

Claims

1. A two part slidably detachable waveguide connector provided on one part (10) with a first waveguide portion (12) biased away from said part by spring means (15) and on the other part with a second waveguide portion arranged to mate with said first waveguide portion, characterised in that said first waveguide portion is mounted for sliding movement in the axial direction on said one part and in that a tubular outer sleeve (1, 25) is provided on either part which sleeve slidably locates said portions and surrounds their mating interface (9,11) when the connector parts (3, 10) are attached.
2. A waveguide connector as claimed in Claim 1 wherein said outwardly biased waveguide portion (12) is mounted on a male connector part (10) and the tubular outer sleeve (1, 25) is incorporated in a mating female connector part (3).
3. A waveguide connector as claimed in Claim 2 wherein a shutter is provided over the recessed mating surface (9) of the female part (3) of the connector, which shutter is opened by a coarse alignment pin on the male connector part (10) when the parts are brought together.
4. A waveguide connector as claimed in any preceding claim wherein a groove surrounding the inner surface of the waveguide is provided on one of the mating surfaces (9, 11) of the connector.
5. ~~A waveguide connector according to any preceding claim wherein the bodies of the connector parts are relatively aligned by means of one or more dowel pins (30) projecting from one body into a hole in the other.~~
6. A multiple bayonet connector incorporating a waveguide connector as claimed in any preceding claim.
7. An arrangement comprising a waveguide connector as claimed in any of Claims 1 to 5, said arrangement further comprising guide means (23, 24) distinct from

said connector which in use slidably locate the connector parts (3, 10) and align them when said parts are separated.

8. An arrangement according to Claim 7 wherein a rack (22, 23, 24) constitutes said guide means and one of
- 5 said waveguide connector parts is mounted on the rear of the casing (21) of a rack-mountable piece of equipment and the other of said waveguide connector parts is mounted at a corresponding position on the rack, so that the connect-
- 10 or parts can be mated by sliding the equipment into the rack and held in position by frictional engagement between said piece of equipment and said rack.
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Fig .1.

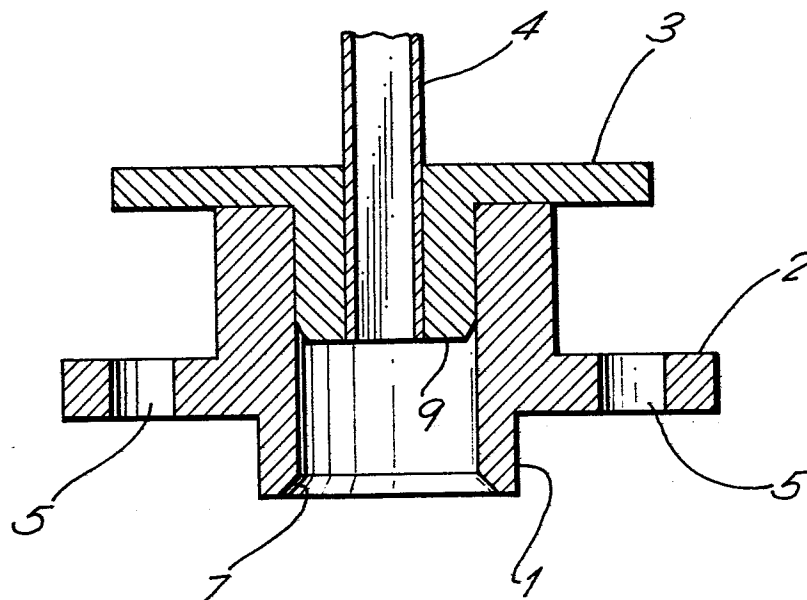


Fig .2.

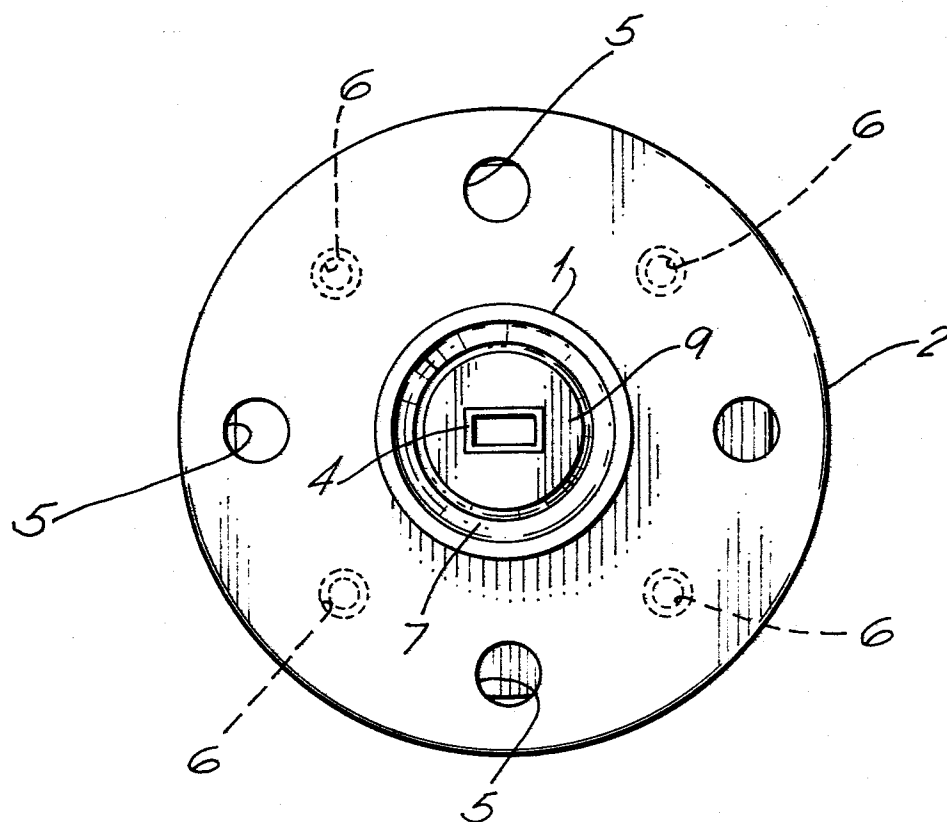


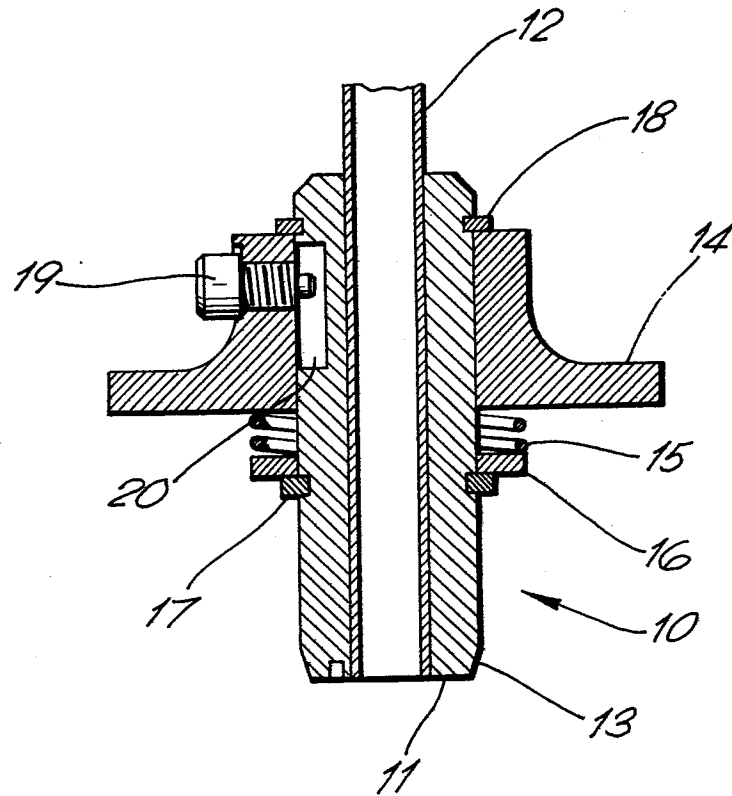
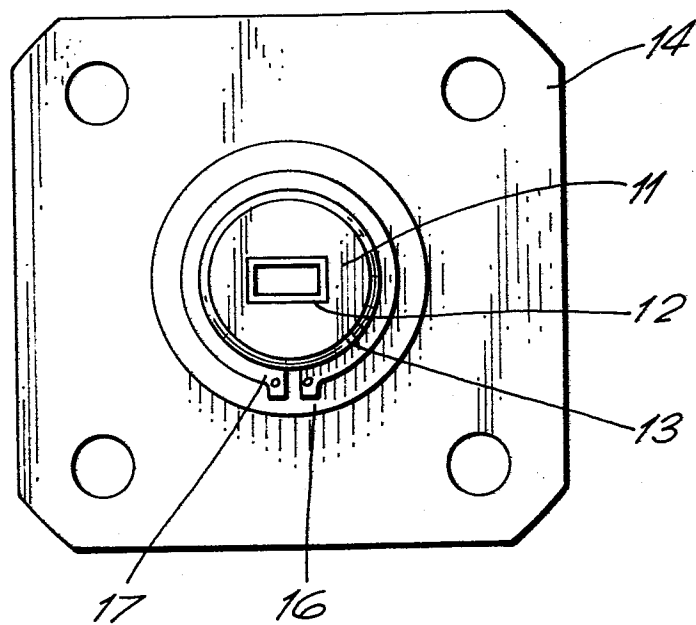
Fig . 3.*Fig . 4.*

Fig .5.

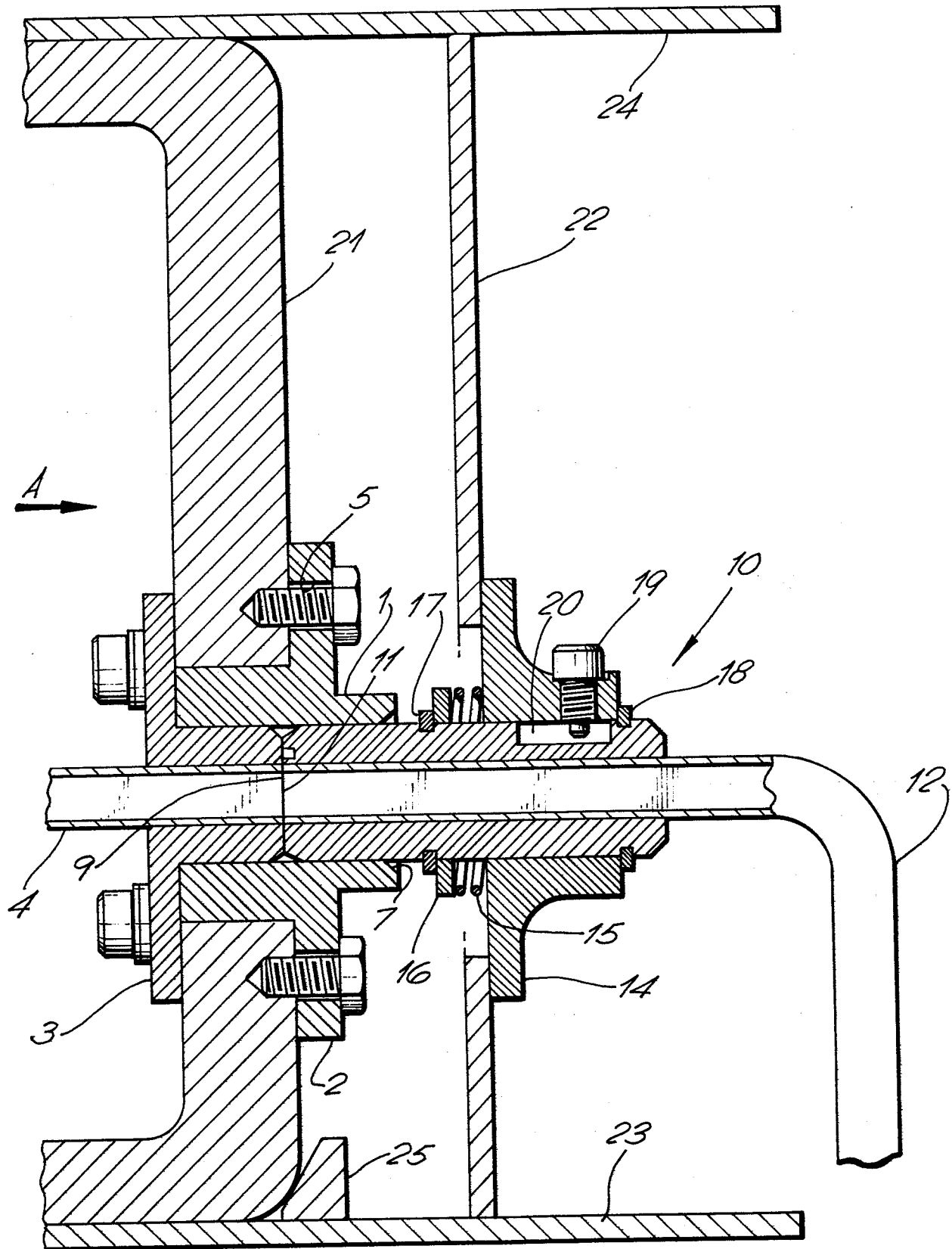


Fig. 6b.

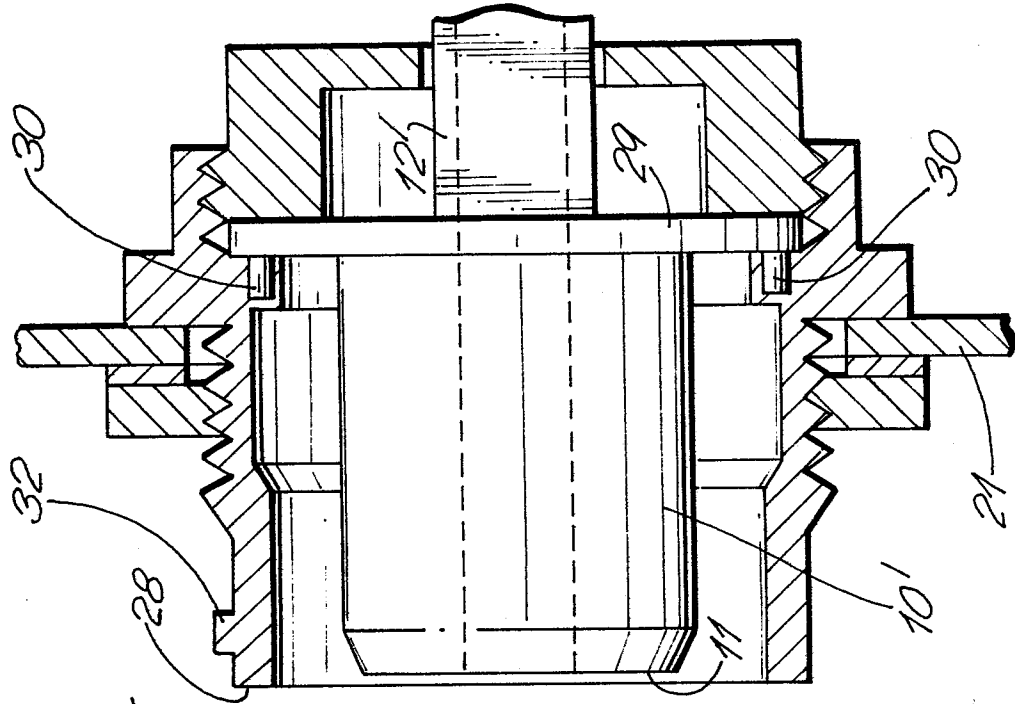


Fig. 6a.

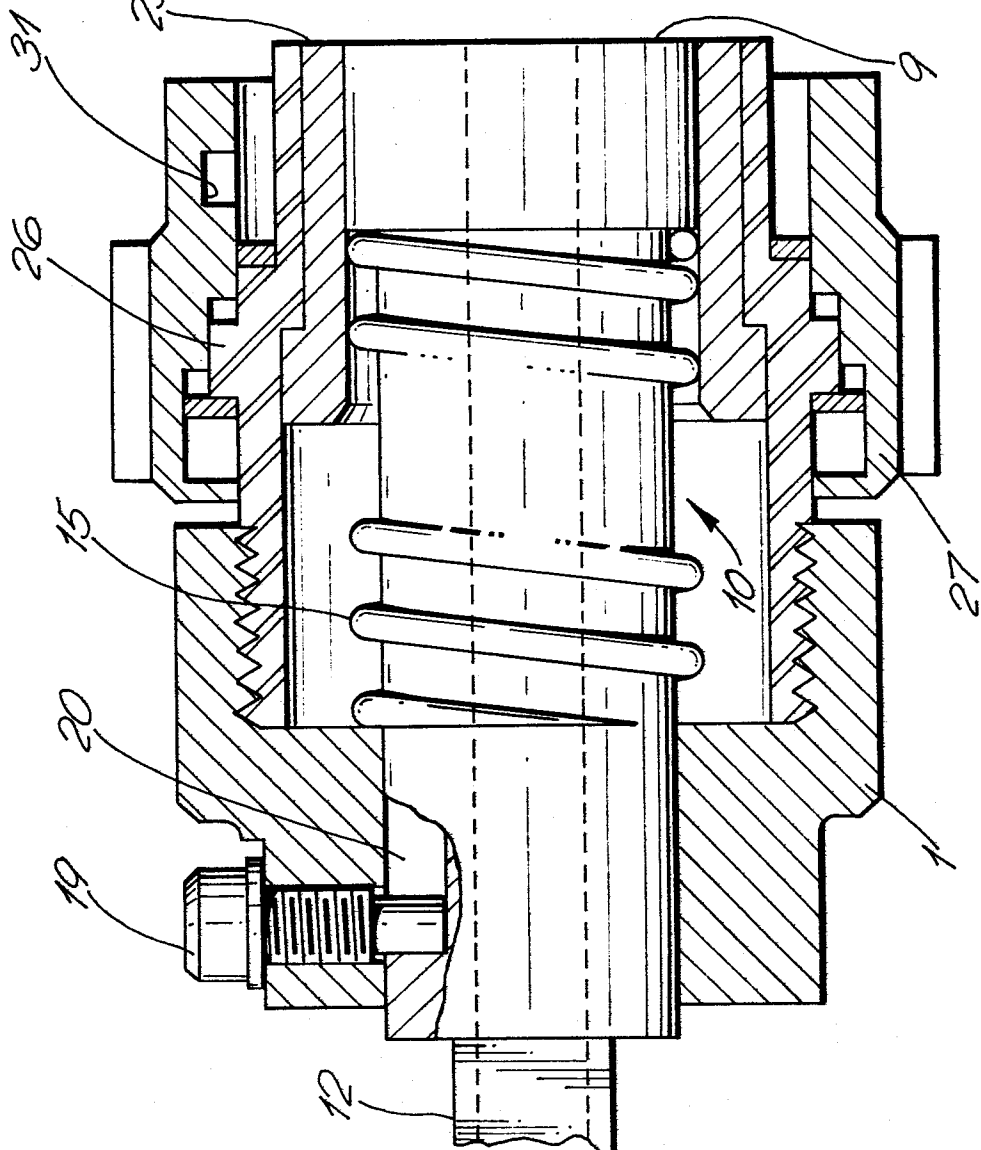
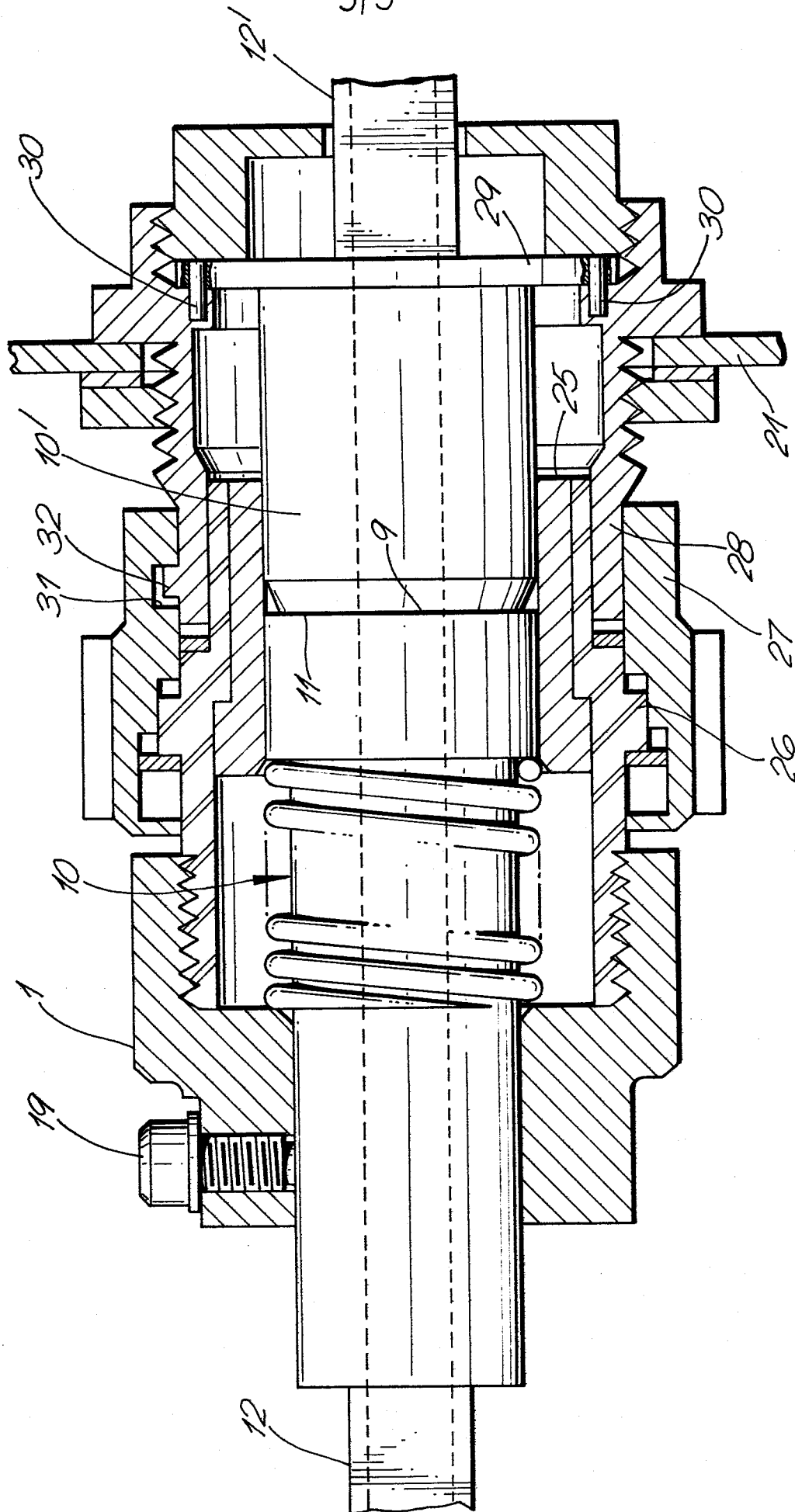


Fig. 7.





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. ³)
A	US-A-2 928 059 (G. CHAMBERLAIN et al.) * Whole document *	1	H 01 P 1/04
A	US-A-3 383 633 (A.M. HAVLICSEK et al.)		
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			H 01 P
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 04-09-1984	Examiner LAUGEL R.M.L.
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			