(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 748 899 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.12.1996 Bulletin 1996/51

(51) Int Cl.[6]: **E02D 17/08**

(21) Application number: **96304370.8**

(22) Date of filing: **11.06.1996**

(84) Designated Contracting States:
BE DE ES FR GB IE

(30) Priority: **16.06.1995 GB 9512324**

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(54) Trench hole box

(57) Trenching apparatus (30) for protecting personnel working in an excavation is described. The trenching apparatus (30) comprises two panels (32) positionable in use vertically to support the sides of a trench, the panels (32) being connected and spaced by struts (44) extending therebetween. The panels (32) are shaped such that in use the spacing is a maximum at their lengthwise centres and decreases generally continuously either side thereof to the edges.

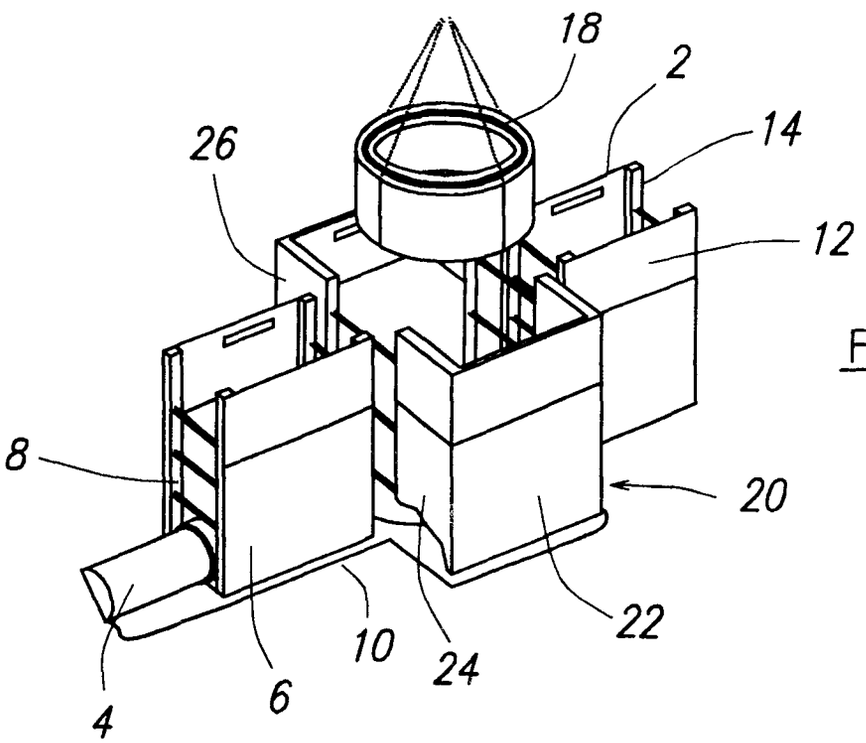

FIG. 1

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Description

This invention relates to trenching apparatus, in particular to trench lining apparatus for use in forming manholes.

Known trench linings comprise steel panels, pairs of which are pin-jointed together face to face to form a box module. The box module is then lowered by an excavating machine into a pre-dug trench. Alternatively in the so-called "dig and push" method, a trench is partially dug, a box module lowered thereinto and then pressed down by the excavating machine. Thereafter the trench is completed by alternate excavation and pressure. The panels may have lower cutting edges to assist in placement and extension panels may be provided, without any cutting edge, which are bolted onto pre-positioned panels. The boxes are located end to end but are not, in general, joined to each other.

At locations where a manhole is required, the trench width must be increased. Thus a widthwise gap is produced on either side of the main trench line between the panels supporting the manhole portion of the trench and those adjacent thereto. Transverse fill-in plates are used to close off these gaps. These may be secured in situ by welding direct to the manhole panels or by bolting to plates themselves welded to the panels. Of recent times, purpose built man-hole boxes have been provided with pre-welded fill-in plates, the struts then extending between the edges of the fill-in plates rather than to the side thereof between the manhole panels. In either case, the struts are subjected to the pressure of the soil behind the fill-in plates which acts transversely to the axes thereof and can cause struts to bend.

The struts generally comprise two or more parts which are relatively adjustable to give a variable strut length. Some play is provided between the two parts to allow for the fact that the strut attachment points will not be exactly oppositely positioned. The sideways pressure on the struts at manholes can cause the parts to jam up and destroy the play therebetween.

Trenching apparatus, in accordance with the invention, comprises two panels positionable in use vertically to support the sides of a trench, the panels being connected and spaced by struts extending therebetween and being shaped such that in use the spacing is a maximum at their lengthwise centres and decreases generally continuously either side thereof to the edges of the panels. The panels may have a V cross-section or a curved cross-section.

The advantage of this is that manholes can be formed without the need for fill-in plates as the shaping of the panels means that no gap is produced between them and the adjacent panels of the main trench line. In addition the amount of excavation required to form the manhole is reduced as the outlines of the trench hole simply need to follow the shape of the panels, which in turn, in effect, follow the shape of the manhole pipe.

The apparatus is cheaper to produce than known purpose-built manhole trench lining as the need to weld or bolt the fill-in panels onto the main panels is obviated. Further there is a saving in material and consequently in weight which may be quite significant as trench lining panels can have weights in the order of 2,000 kg.

The transverse force on the struts connecting the panels is less than with known manhole linings because of the shaping as the weight of the soil nowhere acts directly transversely to the struts. To further reduce potential distortion of the struts, the panels may include connecting means for securing the struts thereto with angled adapters whereby the struts extend generally parallel to a line between the panels' lengthwise centres. The struts are thereby aligned in the direction of maximum force.

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

Figure 1 is a perspective view of a known trench lining system including manhole trench lining apparatus;
Figure 2 is a schematic plan view of the system of Figure 1:
Figure 3 is a section along III-III of Figure 2;
Figure 4 is a schematic plan view of a trench lining system including trenching apparatus in accordance with the invention;
Figure 5 is a plan view of the trenching apparatus of Figure 4; and
Figure 6 is a series of schematic sketches illustrating various struts for use with the trenching apparatus of Figures 4 and 5.

The trenching system of Figure 1 includes a plurality of trench boxes 2, only two of which are illustrated. The boxes 2 are employed to support the walls of a trench in which a pipe 4 is to be laid. The trench boxes 2 comprise a pair of steel panels 6 and adjustable struts 8 pin-jointed to form box modules. The panels 6 may have a lower cutting edge 10. As illustrated, extension panels 12 may be secured to the panels 6 if the height of the trench necessitates this. The extension panels 12 are also spaced and connected by struts 8.

The panels 6 may be, for example, 3.5 m long and 2.5 m high. The width between the pair of panels 6 of a trench box 2 may be between, say, 800 mm and 4,500 mm. The struts 8 are generally adjustable to allow the width to be set at that suitable for the trench width, but to accommodate a width range of the exemplary extent a number of differently lengthed struts are normally provided as part of the trench lining system.

The struts 8 may take any desired form but commonly they have a clevis fitting at both ends which enables them to be pinned to pillars 14, one of which is provided at each end of the panels 6 of the trench boxes 2. Various forms of pillar 14 are known, but that illustrated takes the form of two U cross-section beams posi-

tioned back to back and secured by one flange to the panel 6. A series of spaced aligned holes are provided in the webs for receipt of the bolts whereby the struts are connected. The bolts may be held in place by retaining clips secured through their ends. The system is, therefore, capable of fairly rapid assembly and dis-assembly.

At locations along the trench line where a manhole is to be provided, the width of the trench must be increased to accommodate the manhole ring 18. This results in widthwise gaps between the supporting panels in the manhole area and the panels 6 of the trench boxes 2 either side of the manhole area. The system illustrated in Figure 1 includes a prefabricated "manhole box" 20 which includes panels 22 of similar form to those 6 of the trench hole boxes 2 but without pillars 14, and, side fill-in plates 24 welded to the ends of the panels 22 transversely to the plane thereof. The fill-in plates 24 are provided with pillars 14 whereby they may be connected by struts 8. As with the trench hole boxes 2, the manhole box 20 may be provided with extension panels 26. The length of the manhole box 20 is set by the maximum diameter of ring 18 to be accommodated therein. The width of the fill-in plates 24 must be sufficient so that there will be no gap between these and the panels 6 of the adjacent trench boxes 2, with the maximum diameter of ring 18 and minimum trench box width.

The main pressure, P1, acting on the manhole box 20 is from the soil behind the panels 22. The soil behind the fill-in plates 24, however, also exerts a pressure, P2, and this is transverse to the axes of the struts 8 extending between the fill-in plates 24. This pressure, P2, may bend the struts 8 and/or cause these to seize up so that they are unable to accommodate any misalignment between opposite pillars 14 on the fill-in plates 24.

The trench lining system of Figure 4 includes a manhole box 30 with panels 32 which have a V cross-section. Alternatively, as illustrated in dotted outline, the box may comprise panels 32a with a curved or arched cross-section. The spacing between the lengthwise centres of the panels 32 has to be sufficient to accommodate the maximum diameter ring which is to be employed but the angling or curving means that the edges of the panels 32 can be closer together. As a result, there is a saving in excavation as shown by shaded portion 34.

The panels 32 may be formed by folding or bending or by welding two plates 36 together. In all cases their fabrication is cheaper than that of the manhole boxes 20 in which two fill-in plates 24 have to be connected to a panel 22. Further, less material is required which results in additional cost savings as well as a reduction in weight.

When formed by folding, the panels 32 may define an angle of, say, 120° between the opposite arms thereof such that, in use, the angle 38 between the arms and the vertical plane parallel to the trench line is about 30°.

The panels 32 are provided with connecting means including pillars 40 which may be of the type employed in known trench lining systems and angled adaptors 42 to which the struts 44, which connect and space the panels 32, are secured. The angled adaptors 42 serve to position the struts 44 such that their axes are aligned with a line connecting the lengthwise centres of the panels 32. As a consequence, the strut axes are also aligned in the direction of maximum force thereon due to the soil behind the panels 32. Even if the angled adaptors 42 are not employed, the angling of the panels 32 reduces the effect of the pressure of the soil behind the panels 32 and, thus, the chance of bending or seizure of the struts 44.

The struts 44 may take various forms. In one common form the strut is two-part comprising an externally threaded rod which is received within an internally threaded tube, the rod and tube having a clevis fitting at their free ends. In another form illustrated in Figure 6, the strut 44 comprises two rod and tube fittings 46 positioned back to back and secured together by bolting together plates 48 on the ends of the tube. The rods have similar plates 48 by which they may be bolted to a clevis fitting 50. The clevis fitting 50 may have two lugs 52 with apertures 54 by way of which the fitting 50 is pinned, see 55, to a pillar 40. Additional angled arms 56 with rubber ends 58 may be provided either side of the lugs 52 to form a so-called "rocking plate".

The angled adaptor 42 will take the form suitable for the struts 44 to be employed. For example, if the strut 44 is of the type illustrated in Figure 6, the angled adaptor 42 may include a plate 60 for bolting to the plate 48 at the end of the strut 44 and, at the angled face, a clevis fitting 50 whereby it may be pinned, see 55, to a pillar 40.

In an alternative embodiment not illustrated, the angled adaptors 42 are positioned between the panels 32 and the pillars 40. With the curved panels 32a, the adaptor 42 will include a curved face. The illustrated embodiment, however, has the advantage that the panels 32 can be formed by taking a standard trench lining panel 6 and folding or bending it, or alternatively dividing it into two parts and then welding the parts together at the desired angle. This is a particularly simple method of construction and is most cost effective.

The manhole box 30 is more efficient than known boxes, as illustrated in Figure 1, in terms of the amount of excavation required, material requirements and construction requirements.

Claims

1. Trenching apparatus comprising two panels positionable in use vertically to support the sides of a trench, the panels being connected and spaced by struts extending therebetween and being shaped such that in use the spacing is a maximum at their lengthwise centres and decreases generally continuously either side thereof to the edges.

2. Trenching apparatus as claimed in Claim 1, wherein each panel has a V cross-section.

3. Trenching apparatus as claimed in Claim 1, wherein each panel has a curved cross-section.

4. Trenching apparatus as claimed in any preceding Claim, wherein one or both panels is formed from two or more sheets.

5. Trenching apparatus as claimed in any preceding Claim, wherein the panels include connecting means for securing the struts thereto, the connecting means including angled adaptors whereby the struts extend generally parallel to a line between the panels' lengthwise centres.

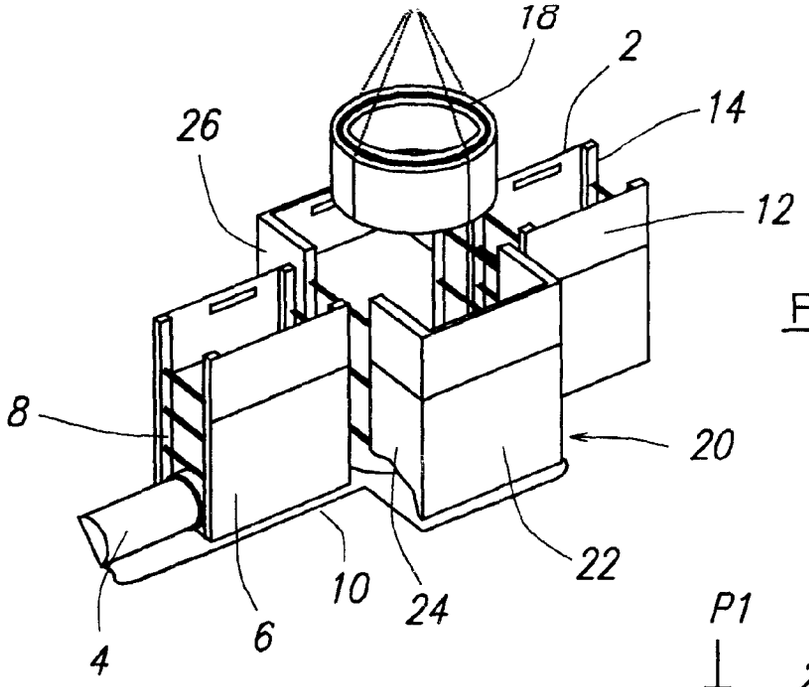

FIG. 1

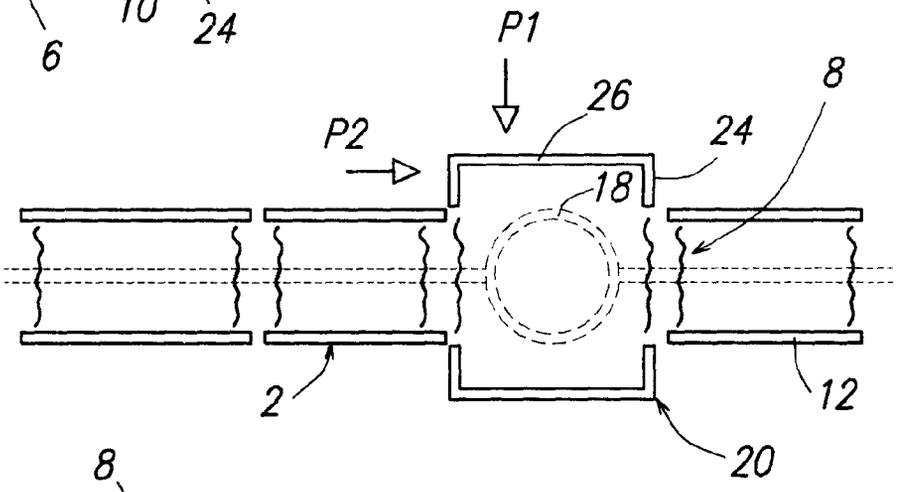

FIG. 2

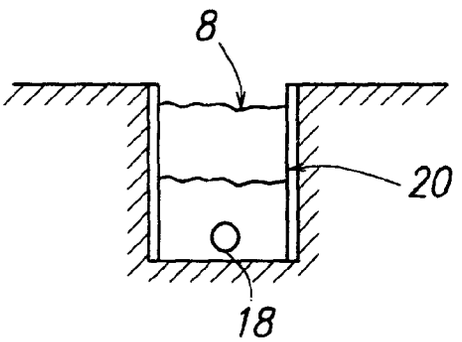

FIG. 3

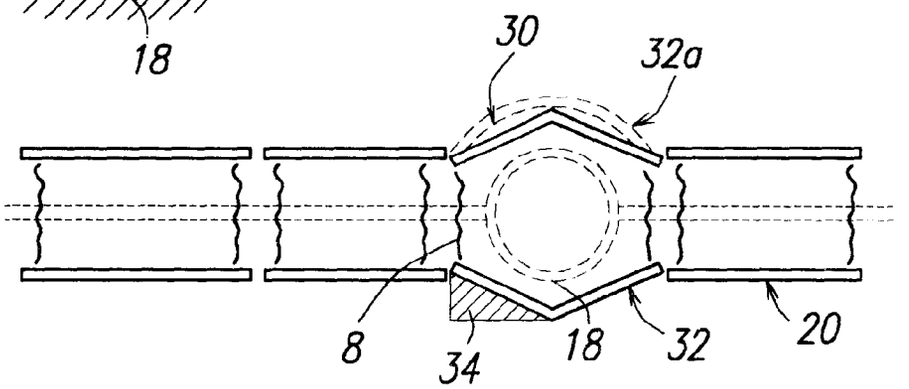

FIG. 4

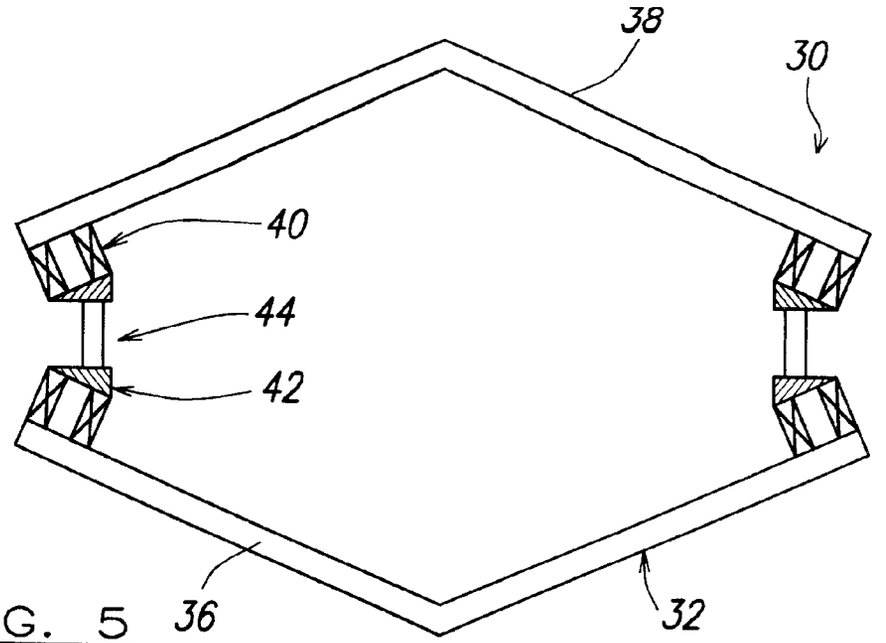
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FIG. 5

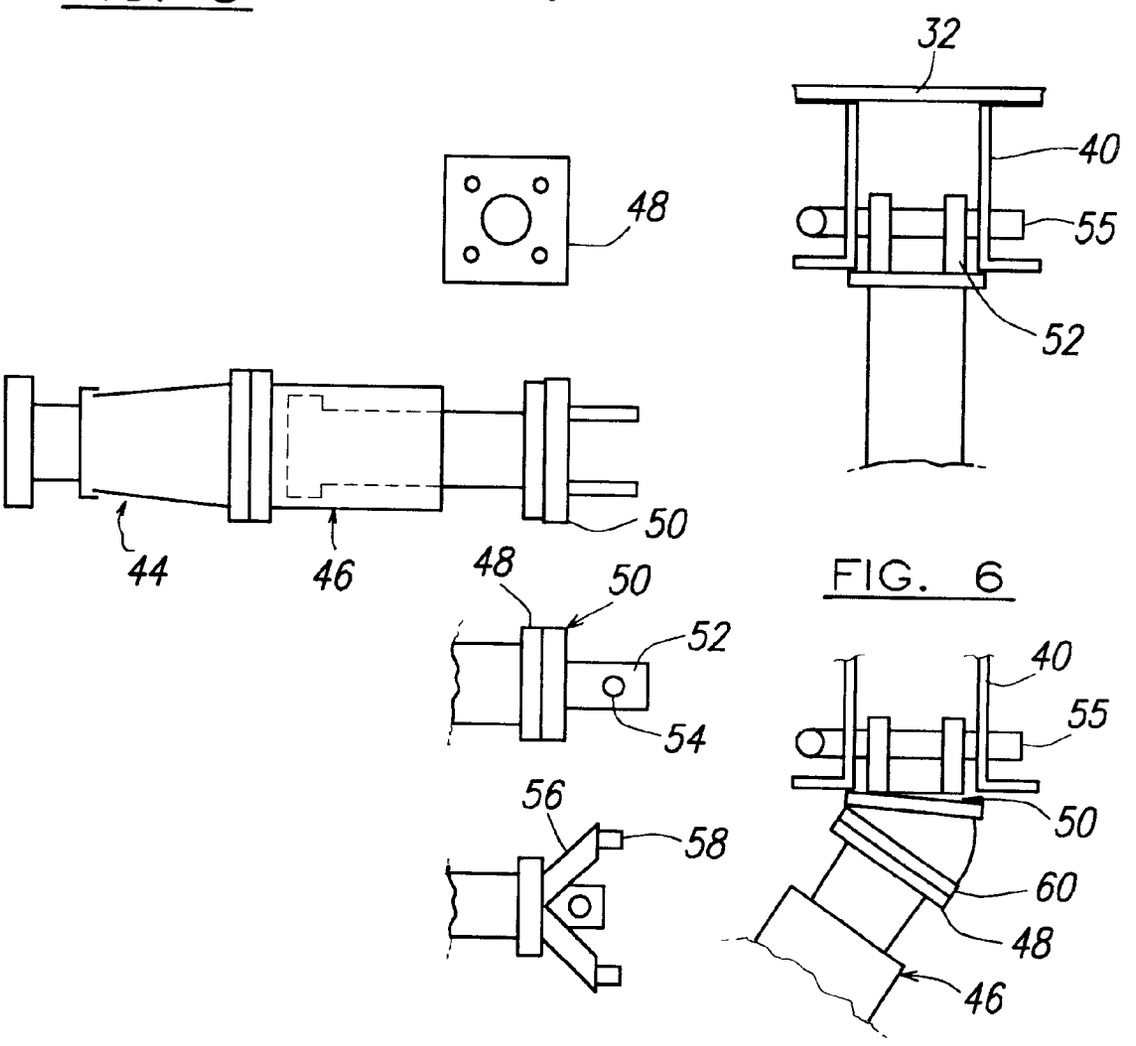
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FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 96 30 4370

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.6)
X	GB-A-2 259 534 (HOLDER KENNETH VICTOR) 17 March 1993	1,2,4	E02D17/08
Y	* the whole document *	5	
A		3	

Y	BE-A-764 529 (BELGE DES BETONS S A SOC;SOTRAHY S A DE TRAVAUX HYDRAUL) 16 August 1971	5	
A	* page 8, line 1 - line 23; figures 3,4 *	1-4	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 September 1996	Blommaert, S

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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