

PATENT SPECIFICATION

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- (21) Application No. 3436/78 (22) Filed 27 Jan. 1978
 (31) Convention Application No.
 7 702 377U (32) Filed 28 Jan. 1977 in
 (33) Fed. Rep of Germany (DE)
 (44) Complete Specification published 1 April 1981
 (51) INT. CL.³ F16L 9/08.
 (52) Index at acceptance
 F2P 1A5 1B2 1B7
 F2M 282 B5



(54) PIPE LINING

(71) We, FRIEDRICHSFELD GMBH.,
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 Steinzeugstrasse, D-6800 Mannheim, Federal
 Republic of Germany, a company organized
 5 under the laws of the Federal Republic of
 Germany, do hereby declare the invention,
 for which we pray that a patent may be
 granted to us, and the method by which it
 is to be performed, to be particularly de-
 10 scribed in and by the following statement:

This invention relates to a combination
 of plates and coupling elements for lining a
 pipe, for example lining a reinforced con-
 crete sewage pipe. As shown in German
 15 Auslegesschrift 2317041, such a lining con-
 sists of a number of plates defining the
 periphery of the said lining, with T-shaped
 anchoring ribs which project from the outer
 surface of the plate and extend in the longi-
 20 tudinal direction of the pipe, these anchor-
 ing ribs all being of the same height and
 with flanges which are arranged on the
 longitudinal edges of the plates and lie
 parallel to the anchoring ribs.

The T-shaped anchoring ribs of this known
 plate serve to anchor the lining to the con-
 crete. The ribs, arranged on the longitudinal
 edges of the plates, of the adjacent plates
 are screwed together so as to attach the
 30 plates to one another.

Such screw connections of adjacent plates
 entail the drawback that the plates are only
 reliably secured at individual points, and
 this restricts the extent to which the inner
 35 lining can be loaded. Moreover, the process
 of assembling the plates to form the inner
 lining is complicated by the necessity of
 effecting the screw connection, as the drill-
 ing of the ribs and the insertion of the
 40 screws is very time-consuming.

Underlying the invention is the object of
 effecting a connection between mutually
 juxtaposed plates which is simple in oper-
 ation, the connection established being
 45 extremely stable and tight-sealing.

According to the invention there is pro-
 vided a combination of a plurality of plates
 and coupling elements for lining a pipe,
 each plate having a flange along each of
 50 two opposite longitudinal edges, each flange

being formed on its inner side with a
 shoulder directed toward the main portion
 of the plate, the inner surfaces of the flanges
 being tapered so that the thickness of each
 flange decreases towards its free edge, each
 55 coupling element extending over the entire
 length of the adjacent plates and being U-
 shaped with gripper jaws on the inner faces
 of the arms of the U to engage the shoulders
 of the flanges of two plates whose longi-
 60 tudinal edges are placed side-by-side and
 having a seal within the coupling element,
 the arrangement being such that the seal
 is compressed by the edges of the flanges
 when the gripper jaws engage the shoulders. 65

Embodiments of the present invention are
 hereinafter more particularly described, by
 way of example, with reference to the
 accompanying drawings, wherein:

Fig. 1 illustrates the assembly of a 70
 number of plates forming sections of an
 inner lining of a concrete sewage pipe;

Fig. 2 is a front view of two plates
 which are interconnected by means of a
 coupling element; 75

Fig. 3 illustrates the way in which a
 coupling is formed, the coupling element
 being shown in its position prior to being
 struck into place;

Fig. 4 is a modification of the coupling 80
 element;

Figs. 5 and 6 show the coupling element
 being struck into position; and

Figs. 7 and 8 show two further ways of
 effecting couplings. 85

As is clear from Fig. 1, four (for example)
 plates are required for assembling a lining
 of a concrete sewage pipe 2. As shown in
 Fig. 2, these four plates are juxtaposed to
 one another and are coupled together by
 90 striking one of the coupling elements 18
 into position in the direction of arrow 11,
 the four plates then being bent to form the
 inner lining. The invention relates to the
 coupling of the plates to one another by 95
 means of the coupling element.

For enabling the lining to be anchored
 in the concrete, the two plates shown in
 Fig. 2 have a number of anchoring exten-
 sions or ribs 8. At each of their longitudinal 100

edges 7 and 9 the plates are formed with a flange 6 (Fig. 3). The flanges 6 of adjacent plates 4 contact one another at a butt point 28.

5 When the plates 4 have been juxtaposed to one another and their flanges 6, the coupling element 18 is struck in the direction of arrow 11, so that it interconnects the flanges 6. Fig. 2 illustrates the position in
10 which the coupling element 18 has been struck into position. It can be seen that the distance $H8$ which the anchoring rib 8 lies above the outer surface 16 of the plate equals the distance $H18$ by which the
15 coupling element 18 lies above the outer surface 16 of the plate. Thus, all the parts projecting from the outer surface 16 of the plates are of the same height, so that the area of the concrete which is free of rein-
20 forcement can be optimally used for anchoring the plates and coupling elements in the concrete.

Fig. 3 shows, on an enlarged scale, the longitudinal edges 7 and 9 of two adjacent
25 plates, whose flanges 6 are juxtaposed to one another to define a butt joint 28. The associated coupling element 18 can be seen above the flanges 6. This coupling element is U-shaped. At its shank ends 20 and 22
30 it carries opposed gripper jaws 24 and 26 whose surfaces 23 and 25, intended to engage behind the flanges of the plates, extend perpendicularly of the direction of arrow 11. The faces of the flanges engaged
35 by the surfaces 23 and 25 extend parallel to the surface 16.

The inner surface 10 of the flanges 6 run upwardly towards one another, so that the juxtaposed flanges define a wedge shape
40 which is symmetrical with respect to the butt joint 28. When the coupling element 18 is struck in the direction of arrow 11, the gripper jaws 24 and 26 slide on the oblique inner surfaces 10 of the two flanges 6 and
45 are resiliently pressed away from one another until they engage in the grooves 12 which are formed in the oblique inner surfaces 10 of the flanges 6 located immediately above the outer surface 16 of the plates.
50 The distance $a34$ of the bottom surfaces of the grooves 12 is slightly greater than the distance $a18$ between the gripper jaws prior to the coupling element being struck into position. This slight difference means
55 that, after the coupling element has been struck into position, the gripper jaws 24 and 26 of the coupling element will press into the grooves 12 and thus compress the adjacent flanges 6 at the butt joint 28.

60 This compression at the butt joint will generally suffice for sealing purposes, although it will be found advantageous to place a resiliently yielding seal 40 on the base surface 36 of the coupling element 18.
65 This seal 40 is preferably stuck in place.

When the coupling element is struck in the direction of arrow 11 this seal 40 is compressed and extends at least partially into the gaps between the inner surfaces 10 of the flanges 6 and the inner surfaces 30 and 32 of the coupling element 18. This position of the seal 40 is shown in Fig. 5.

For enabling the lining to be anchored in the concrete the coupling element 18 is wider near the bend of the U than at the ends of its arms. As shown in Fig. 3 the element 18 has, extending both to the right and left, a respective anchoring rib 44, 46. The coupling element shown in Fig. 5 has similar anchoring ribs whereas, instead of
80 being provided with such ribs, the coupling element 18 shown in Fig. 4 is thicker in its upper portion than at its lower portion.

Instead of the seal 40, shown in Fig. 3 and stuck in position, a sealing cord 42 of
85 foamed material (elastomer) is arranged in the sealing element of Fig. 4, this sealing cord almost completely filling out the space surrounded by the coupling element 18. This sealing cord 42 preferably rests on the gripper jaws 24 and 26, so that it is irremovably held by these jaws 24 and 26 inside the coupling element 18. No sticking is
90 needed. Further, this sealing cord 42 fills out the inside space of the coupling element 18 to such an extent that reliable protection is afforded against the penetration of contaminants or foreign bodies. This affords the advantage that such contaminants cannot hinder the coupling of adjacent plates.
100

For assembling the coupling element 18 the longitudinal edges 7 and 9 of the plates are placed on a support 13 which is intended to support the two longitudinal edges with the greatest possible uniformity. At one
105 end of the plate connection to be formed the coupling element 18 is then placed, by its gripper jaws 24 and 26, on the inner surface 10 of the juxtaposed flanges 6 and, in this position, is struck in the direction
110 of arrow 11 so as to grip these flanges 6. As Fig. 6 shows, the coupling has now been formed in a short starting area *b*. A partial overlap between the coupling elements 18 and the flanges 6 can be seen in an adjacent
115 intermediate area *c*. In this intermediate area *c* the shanks of the coupling element are bent apart from one another to a greater or lesser degree, and the coupling element is bent. The coupling element must be
120 sufficiently resilient to allow this.

By continuing, in the direction of arrow 15, the process whereby the coupling members are struck into place, the adjacent plates are coupled to one another over
125 their whole length.

If the plates from which the inner lining is to be assembled are of too small a width for producing an inner lining of the required diameter, a coupling element is preferably
130

used which has a central strip 52 which projects into the butt joint, as shown in Fig. 8.

As Fig. 7 shows, the inner surface 30, 32 of each shank of the U-shaped coupling element 18 is formed, close to the base surface 36, with a respective strip 58, 60 which extends in the longitudinal direction. These strips 58 and 60 serve to constrict the space enclosed between the two shanks and the base surface 36. A flat sealing cord 42, which in this embodiment is approximately rectangular in cross-section, lies, on the one hand, between the two strips 58 and 60 and, on the other hand, the base surface 36. It is clear from Fig. 7 that the constriction formed by the two strips 58 and 60 is positioned at a slightly lower level than the highest region of the flanges 6. The result of this is that, when the flanges have been coupled together, they compress the sealing cord 42, whereby the required tight seal is realised.

Fig. 8 illustrates an embodiment in which the coupling element 18 comprises the above-mentioned central strip 52. In this embodiment the space which accommodates the sealing cord 42 is divided by the central strip 52; the consequence of this is that the central strip 52 has shoulders and recesses both on the right and left-hand sides which precisely correspond to the recesses in the inner wall 30, 32 which are defined by the strips 58 and 60. A sealing cord is positioned in each of the two chambers defined by, firstly, a strip of the inner wall 30, 32 and secondly, a recess of the central strip 52 (as in the embodiment shown in Fig. 7).

The recesses in the inner walls 30 and 32 are designated by reference numeral 64 whereas the recesses in the central strip 52 are designated by reference numerals 62.

It will be seen that in the embodiments of Figures 4, 5, 7 and 8, the coupling member has an outer surface which is highest in the middle. It may be generally smoothly rounded, or formed with a ridge 50 as shown in Figure 5.

WHAT WE CLAIM IS:—

1. The combination of a plurality of plates and coupling elements for lining a pipe, each plate having a flange along each of two opposite longitudinal edges, each flange being formed on its inner side with a shoulder directed towards the main portion of the plate, the inner surfaces of the flanges being tapered so that the thickness of each flange decreases towards its free edge, each coupling element extending over the entire length of the adjacent plates and being U-shaped with gripper jaws on the inner faces of the arms of the U to engage the

shoulders of the flanges of two plates whose longitudinal edges are placed side-by-side and having a seal within the coupling element, the arrangement being such that the seal is compressed by the edges of the flanges when the gripper jaws engage the shoulders.

2. The combination as claimed in claim 1, wherein the seal comprises a sealing cord stuck to the central inner surface of the coupling element.

3. The combination as claimed in claim 1, wherein the seal comprises a sealing cord restrained within the coupling element by longitudinal projections along the inner surfaces of the arms of the U.

4. The combination as claimed in claim 1, wherein the seal comprises a sealing cord of foamed elastomer restrained within the coupling element by said gripper jaws.

5. The combination as claimed in any one of claims 1 to 4, wherein the surface of the shoulder facing the main portion of the plate extends parallel to said main portion.

6. The combination as claimed in any one of claims 1 to 5, wherein the gripper jaws when in engagement with the shoulders of the flanges are spaced from the base of the flanges.

7. The combination as claimed in any one of claims 1 to 6, wherein the coupling element is wider in the area of the bends of the U than in the region of the ends of its arms.

8. The combination as claimed in claim 7, wherein the coupling element is formed with outwardly extending ribs to provide the wider portion in the area of the bends of the U.

9. The combination as claimed in any one of the preceding claims, wherein the outer surface of the coupling element is highest in the middle.

10. The combination as claimed in claim 9, wherein the middle of the coupling element is formed with a ridge extending longitudinally.

11. The combination as claimed in any one of the preceding claims, wherein the coupling element has a central portion extending between adjacent plates.

12. The combination of a plurality of plates and coupling elements substantially as hereinbefore described with reference to and as illustrated in Figs. 1 to 3, alone or as modified by any one of Figs. 4, 5, 7 and 8.

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1587101

COMPLETE SPECIFICATION

3 SHEETS

*This drawing is a reproduction of
the Original on a reduced scale*

Sheet 1

Fig 1

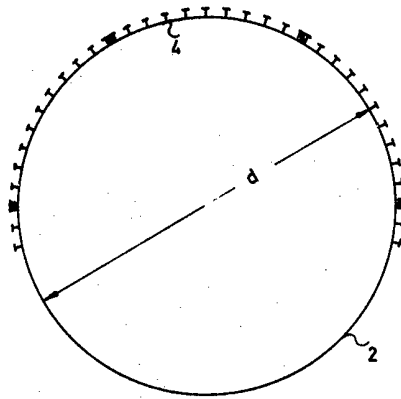
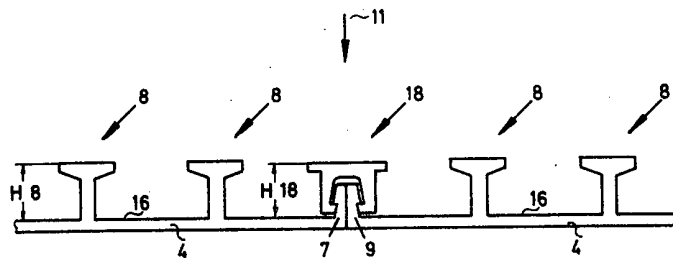


Fig 2



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3 SHEETS

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the Original on a reduced scale

Sheet 2

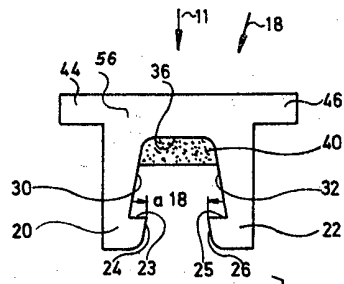


Fig 3

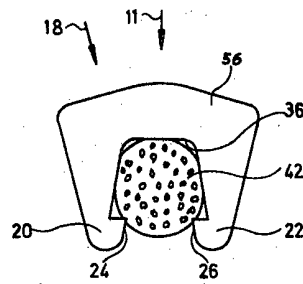


Fig 4

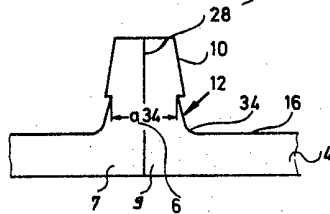


Fig 5

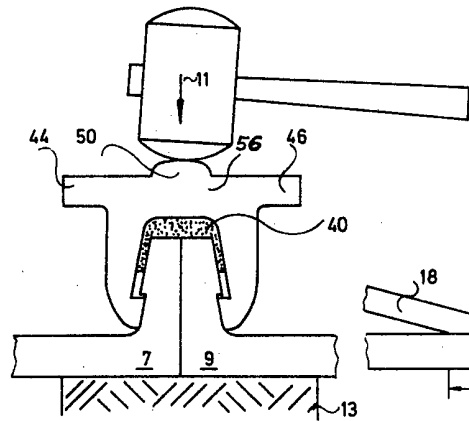


Fig 6

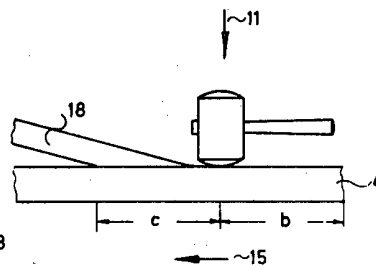


Fig 7

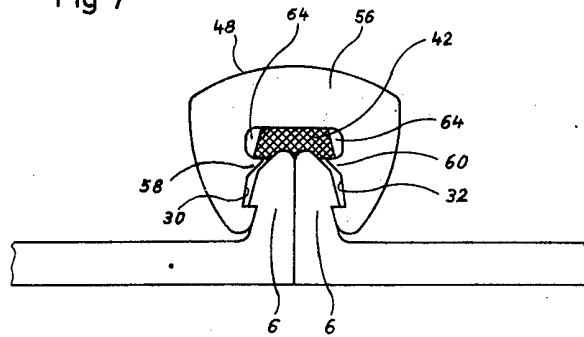


Fig 8

