

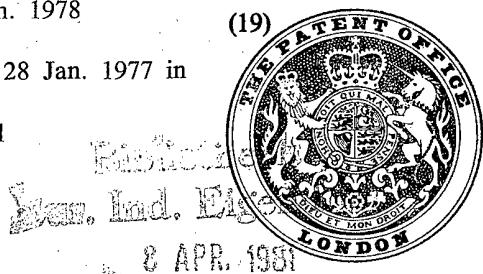
PATENT SPECIFICATION

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(54) PIPE LINING

(71) We, FRIEDRICHSEID GMBH., STEINZEUG- UND KUNSTSTOFF-WERKE, of 50 Steinzeugstrasse, D-6800 Mannheim, Federal Republic of Germany, a company organized 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 described 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 concrete sewage pipe. As shown in German Auslegesschrift 2317041, such a lining consists 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 longitudinal direction of the pipe, these anchoring 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 concrete. The ribs, arranged on the longitudinal edges of the plates, of the adjacent plates are screwed together so as to attach the 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 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 drilling of the ribs and the insertion of the screws is very time-consuming.

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

According to the invention there is provided a 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 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 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.

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 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;

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 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.

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 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 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 extensions or ribs 8. At each of their longitudinal

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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 reinforcement 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 70 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 that at the 75 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 90 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 needed. Further, this sealing cord 42 fills out the inside space of the coupling element 95 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 of arrow 11 so as to grip these flanges 6. As Fig. 6 shows, the coupling has now been 110 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 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 115 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 120 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, 5 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 10 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 15 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 20 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 25 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 30 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 35 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).

40 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 emodiments of 45 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.

50 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 55 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 60 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 65 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.

70 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 75 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 80 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 85 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 90 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 95 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 100 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 preceeding claims, wherein the 105 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 110 longitudinally.

11. The combination as claimed in any one of the preceeding 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 120 8.

8. For the Applicant(s):—

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Sheet 1

Fig 1

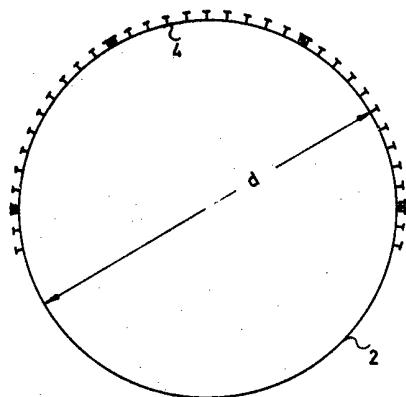
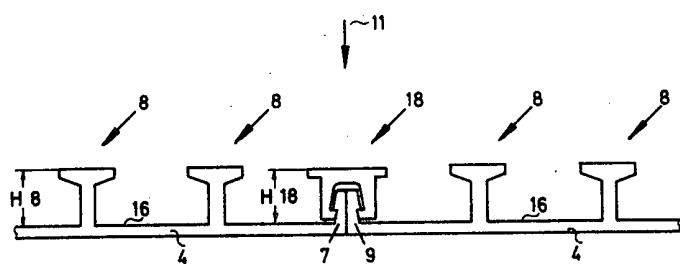


Fig 2



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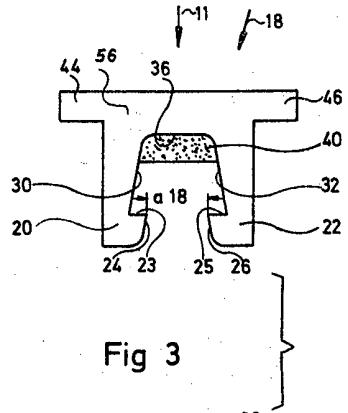


Fig. 3

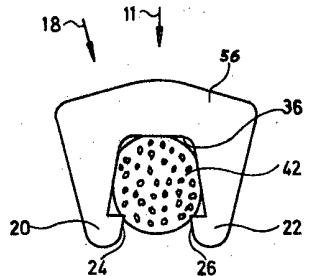


Fig 4

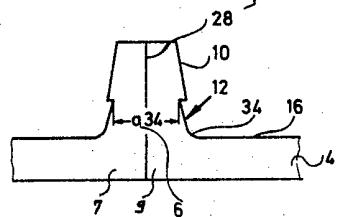
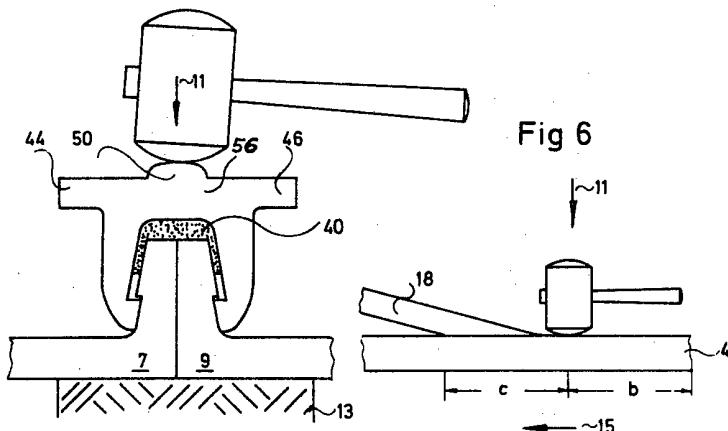


Fig 5



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Fig 7

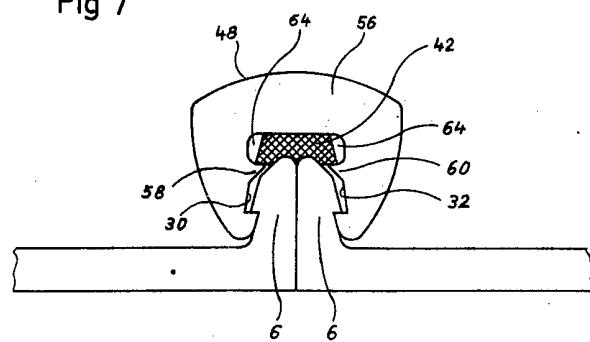


Fig 8

