

The invention relates to a pipe connection in accordance with the preamble of claim 1.

Recently there has been an increasing tendency to use what is known as the advance working technique to lay drainpipes and the like underground. In the advance working technique, the pipes are advanced from a central shaft or a trench in the required directions as far as another shaft, the distance over which pipes are laid at the present time being about 75 to 100 m, although this will increase. More particularly, pipes having nominal diameters of 250 to 1000 mm can be advantageously laid by this advance working technique. Its advantage is that it is no longer necessary to dig shafts over the entire laying length for the underground laying of drainpipes. This therefore not only does away with expensive excavation work, but, in addition, the otherwise necessary traffic hold-ups can be kept to a minimum.

However, the lengths of pipes laid underground by the advance working technique are limited by the diameter of the central shaft. In the case of a shaft diameter of 2 m, pipes of a length of about 1 m can be advanced from the shaft. In the case of a shaft diameter of 3 m it is possible to advance pipes of a length of 2 m. In other words, in the advance working technique the length of the pipes to be laid is limited, so that a number of pipe connections are required to join the pipes to form a pipeline.

The pipe connections are particularly important when pipes are laid underground by the advance working technique, since the pipe connections must not project beyond the pipe either externally or internally. They must not project internally because drainpipes are usually laid with a slight gradient and the projections in the pipe would then constitute obstacles to the discharge of effluent. External projections of the pipe connection interfere with the advancing of the pipes, since considerable friction forces have to be overcome. The forces built up by a pipe connection in the event of external projections would be correspondingly large, so that there would be a risk of the external projections shearing off. Apart from this, externally projecting ribs or the like entrain soil during the advancing of the pipes, so that earth may collapse during underground laying of the pipes. Although force reduction is possible by the use of lubricants, this entails extra outlay and the force

reduction that can be achieved as a result is inadequate, particularly in view of the long laying lengths of 100 m and more.

The advance working technique frequently makes use of concrete pipes of a length of 1 m, asbestos cement pipes particularly being used. Compared with cast iron pipes, these concrete pipes are ten times as thick, so that pipe connections in concrete pipes of this thickness can without difficulty be provided without any projections externally or internally. Although there is good longitudinal force transmission with concrete pipes of such thickness, a very large amount of material has to be moved during the advancing of the pipes with such large outside diameters. Also, very considerable forces build up due to the thickness of the pipes over long laying lengths.

For this reason, the tendency has been to use cast iron pipes jacketed with concrete pipes (DE-PS 36 18 334). The cast iron pipes are used to transmit the compression forces. Conventional socket connections are used to connect the cast iron pipes, the latter having a widened portion at one end to produce a socket, while at the other end they are constructed as an insert for the socket. However, it is an expensive matter to jacket the cast iron pipes, because a steel mat is laid around the cast iron pipe, and concrete is poured over it, and is then vibrated. It is therefore an expensive and complex process to conceal external projections of the pipe connection. Another disadvantage is that cast iron pipes having a short length of 1 m have to be made with different end constructions, i.e. a socket at one end and an insertion end at the other end. In actual fact, however, the tendency in practice for reasons associated with manufacture is to make cast iron pipes in a long length of 6 to 7 m. It would be cheaper to cut these pipes to lengths of 1 m and then use shortened pipes of this kind for laying by the advance working technique. Such pipes are then made without a socket and a corresponding insertion end.

The object of the invention is to provide a pipe connection which projects neither externally nor internally and can be accommodated equally well with a minimum advance working pipe thickness, special end constructions of the cast iron pipes being avoided as far as possible.

This problem is solved according to the invention by the features contained in the characterising part of claim 1, advantageous other aspects of the invention being characterised by the features contained in the sub-claims.

According to the invention, inner cast iron pipes, preferably of ductile cast iron, all of which are without sockets, i.e., are of the same construction at both ends, are used for the compression force. It is thus possible to use lengths of piping cut from long pipes. Space to accommodate suitable coupling elements between the abutting ends of the pipes for connection is created by appropriate configuration of the advance working pipes comprising an intermediate layer and an outer jacket pipe acting as a permanent formwork for the intermediate layer. In detail, at least one sealing ring is used, which is disposed or mounted on an end section of the cast iron pipe or pipes of the two advance working pipes, such end section projecting relatively to the intermediate layer. The sealing rings may be conventional sealing rings for pipe socket connections, so that the thickness of the cement intermediate layer is limited in practice by the height of these sealing rings. The outer jacket pipe acts as a permanent formwork for the mortar layer and contributes to achieving an outer surface as smooth as possible. The friction forces occurring during the advancing of the pipes are thus greatly reduced.

Plastic or asbestos cement can be used for the outer jacket pipe, but a spiral-seam pipe is preferred, i.e. a pipe wound from a sheet-metal strip, the overlap seams pointing inwardly. The spiral-seam pipe is characterised by simplicity of production and cheap price. The outside is comparatively smooth so that frictional forces are reduced. The inwardly projecting overlap seams serve to anchor the intermediate layer and also as a reinforcement for the mortar intermediate layer. Material after the style of cement mortar is suitable for the intermediate layer, i.e. cement mortar or similar material which can be introduced as mortar into the space between the jacket pipe and the cast iron pipe. Thus instead of cement mortar it is possible to use expanded concrete and the like. However, because of its low cost mortar is suitable and it is important that the material should be of low-shrinkage as far as possible.

In another aspect of the invention, a spacer ring is provided which must withstand the internal pressure. This spacer ring forms part of the pipe connection and may be made from steel, cast iron, plastic, asbestos cement or another suitable material. Steel or steel sheet is particularly suitable however.

In one particularly advantageous development of the invention, a ring is floatingly positioned in the area of the butt joint of the two internal cast iron pipes and has an inwardly radially projecting tongue which engages in the joint between the end faces of the abutting cast iron pipes. A ring of T-shaped cross-section is preferred, and the material of the ring should be softer than the material of the cast iron. Soft iron or aluminium or copper are suitable material. This floatingly positioned ring is very important for perfect force transmission, since during advancing over long distances bending may occur, which may be taken by compression of the T-ring. If necessary, the ductile cast-iron takes the bending by compression or distortion if the bending can no longer be compensated for by the T-ring.

It is particularly advantageous to use two sealing rings, each being associated with one of the advance working pipes and fitting on the axially projecting end section of the inner cast iron pipe. A perfectly sealed connection is guaranteed by the use of the cast iron pipes and two sealing rings per pipe connection.

Advantageously, the advance working pipes are constructed as a prefabricated unit comprising the inner cast iron pipe, the outer jacket pipe and the intermediate layer between the jacket layer pipe and the cast iron pipe. In one advantageous aspect of the invention, the spacer ring and, where applicable, one of the sealing rings, are integrated in the prefabricated advance working unit, so when the pipes are assembled only the T-ring and possibly another sealing ring at the end of the other advance working pipe have to be fitted.

The invention is distinguished by a very compact construction of the advance working pipes, the thicknesses being lower by a factor of 10 compared with conventional cement and concrete pipes, so that for the same nominal diameter much less material has to be displaced during the advancing of the pipes. The build-up of forces during advancing is thus much

reduced. This means that during the pipe advance the forces are reduced compared with conventional cement pipes, so that laying is accompanied by much less damage. Since the inner cast iron pipes are the same at both ends, i.e. they are more particularly made without widening to form a socket, the pipes can immediately be cut off from long pipes without any additional pipe treatment being required. Thus the price of such advance working pipes is reduced considerably. The material of the intermediate layer also has a secondary action as an anti-corrosion protection for the cast iron pipe. No reinforcing of the concrete intermediate layer is necessary in view of the spiral-seam pipe. At the same time, the spiral seam pipe with inwardly projecting overlap seams guarantees a very smooth outer surface, so that the frictional forces occurring during the advance of the pipes are reduced.

Exemplified embodiments of the invention will be described below with reference to the drawing, Figs. 1 to 4 of which show different exemplified embodiments of the pipe connection in section and diagrammatically.

The two advance working pipes 2 and 3 interconnected by the pipe connection 1 each comprise an inner pipe 4 made of ductile cast iron, which can be coated with cement internally at 5. The inner cast iron pipe 4 is surrounded, with radial spacing, by a coaxially arranged outer jacket pipe 6. The space between the inner cast iron pipe 4 and the outer jacket pipe 6 is filled by an intermediate layer 7. Cement mortar is particularly suitable as a material for the intermediate layer 7, although other similar materials can be used, for example, expanded concrete and the like, although as far as possible low-shrinkage materials should be used. Cement mortar is particularly suitable because of its low cost.

The jacket pipe may be made from asbestos cement or plastics, but in the exemplified embodiment illustrated is formed more particularly as a spiral-seam pipe, i.e., it is made from a sheet-metal strip wound to form a pipe. The projections 8 at the overlaps occurring during the manufacture of the spiral-seam pipe are directed inwardly in this case, however, so as to form a jacket pipe surface having a smooth outer surface. The inwardly projecting ribs 8 act as reinforcing ribs for the cement mortar intermediate layer 7.

The two inner cast iron pipes 4 project axially beyond the intermediate layer 7 at the ends so that the sealing rings 9 and 9a can be arranged to abut the intermediate layer 7 at the end face. Conventional sealing rings can be used, and, more particularly, have at the top at 10 a recess to receive a spacer ring 11. Suitable material for the sealing rings is natural rubber and vulcanised rubber. More particularly, the sealing rings may be made from Tyton®. The spacer ring 11 may be made from cast iron, plastics, or asbestos cement, but, more particularly, from steel or sheet metal.

A ring 12, which is of T-shape in the exemplified embodiment illustrated, is positioned floatingly in the region of the butt joint between the aligned cast iron pipes 4. The web 13 of the ring 12 extends into the region of the butt joint, the two pipes 4 abutting the flanks of the web 13. The two limbs of the ring 12 overlap the two end sections of the cast iron pipes 4. The ring 12 is made of a material which is softer than the material of the cast iron pipes, soft iron, or aluminium or copper, in particular, being used. The T-ring 12 must be able to take deformation, so that any bending occurring during the advance working over long distances can be taken or compensated for by compression of the T-ring. If necessary, the ductile cast iron takes these bends by compression or deformation.

As will be apparent from Fig. 1, in the case of the advance working pipe 2 shown on the left in Fig. 1, the outer jacket pipe 6 is flush with the end face of the intermediate layer 7, whereas the jacket pipe 6 at the left hand end of the advance working pipe 3 shown on the right extends axially beyond the intermediate layer 7 and also beyond the projecting end section of the inner cast iron pipe 4, so that a reception chamber for the two sealing rings 9 and 9a, and the spacer ring 11, and the T-shaped ring 12, is formed between the projecting end of the outer jacket pipe 6 and the projecting end sections of the two pipes 4. It will be seen that the thickness of the advance working pipes 2 and 3 is reduced to the thickness of the cast iron pipe plus the height of the conventional sealing rings 9 and 9a inclusive of the thickness of the outer jacket pipe 6, it being possible for the latter to be dimensioned to be correspondingly thin-walled, because it simply has to perform the function of a permanent formwork for the intermediate layer 7. That means that the advance

working pipes 2 and 3 constructed in accordance with Fig. 1 are distinguished by a very thin-walled construction.

The advance working pipes 2 and 3 are fitted as a prefabricated unit in the works, consisting of the inner pipe 4, the outer jacket pipe 6 as permanent formwork and the intermediate layer 7, more particularly of cement mortar. On the site it is only necessary to insert the T-shaped rings, the sealing rings and the spacer ring.

The embodiment shown in Fig. 2 corresponds largely to the embodiment according to Fig. 1 so that like references have been used for like parts. The difference is that the advance working pipe 3 shown on the right in Fig. 2 is made as a prefabricated unit inclusive of the sealing ring 9a and spacer ring 11. Assembly is thus simplified, since only the additional sealing ring 9 and the floatingly positioned T-shaped ring 12 have to be fitted on the site. Finally, in this embodiment, since the spacer ring 11 is embedded in the prefabricated unit, the material of the intermediate layer is also drawn over the spacer ring 11 at 14.

The embodiment shown in Fig. 3 differs from the previous embodiments in that only one sealing ring, namely the sealing ring 9, is used on the advance working pipe 2 shown on the left. The spacer ring 11 made of sheet metal is in this case embedded in the material of the intermediate layer 7 at 15, so that the advance working pipes according to Fig. 3 are constructed as a prefabricated unit consisting of an inner cast iron pipe 4, outer jacket pipe 6, intermediate layer 7, and with an integrated spacer ring 11 at one end. On the site, therefore, only the sealing ring 9 and the T-shaped ring 12 have to be introduced or fitted. Because of the elimination of one of the two sealing rings, however, this embodiment does give up the advantage that the connection is absolutely water-tight, since in this embodiment the water pressure is present because of the absence of one sealing ring directly before the concrete of the intermediate layer 7.

The embodiment shown in Fig. 4 is characterised in that the T-shaped ring 12 is so constructed as to simultaneously accommodate the two sealing rings 9 and 9a by the corresponding recesses, so that the sealing

rings and the T-shaped ring 12 can be fitted as a unit when the two pipes are joined together. Tyton® is used as the material for the T-shaped ring and for the two sealing rings 9 and 9a.



C L A I M S

1. A pipe connection on advance working pipes (2, 3) laid underground by the advance working technique and comprising an inner pipe (4) made of cast iron to which the compression force is applied during the advance working, and a coaxially located outer jacket pipe (6), said jacket pipe having a larger diameter than the cast iron pipe (4) and forming a permanent formwork for an intermediate layer (7) made of cement-mortar type material between the inner and outer pipes (4, 6), characterised in that each inner pipe consists of a cast iron pipe (4) constructed without a socket, in that the pipe connection (1) comprises at least one sealing ring (9, 9a) on an end section of the inner cast iron pipe (4), said end section projecting relatively to the intermediate layer (7) and being overlapped by a projecting end section of the other advance working pipe, and in that a spacer ring (11) and/or a ring (12) is located between the advance working pipes (2, 3) for connection.

2. A pipe connection according to claim 1, characterised in that the spacer ring (11) abuts a sealing ring (9) of the pipe connection at only one such ring and additionally is anchored relatively to the intermediate layer (7) of the other advance working pipe, and in that the spacer ring, at one sealing ring (9, 9a) at each end-section of the advance working pipes (2, 3) which are to be joined together, is received at, or is positioned between, the two sealing rings (9a, 9a).

3. A pipe connection according to claim 1 or 2, characterised in that the spacer ring (11) is overlapped by the jacket pipe and/or the intermediate layer (7) of one or both of the advance working pipes (2, 3).

4. A pipe connection according to any one of the preceding claims, characterised in that the jacket pipe (6) of sheet metal, asbestos cement or plastic is preferably manufactured from a sheet metal spiral-seam pipe, the overlapping seams (8) of which are located on the inside of the jacket pipe (6) and form reinforcement ribs for the intermediate layer (7).

5. A pipe connection according to any one of the preceding claims, characterised in that the inner cast iron pipes (4) are arranged in alignment with one



another and in that a ring (12) is floatingly positioned in the area of the butt joint of the two cast iron pipes (4), to engage by a projecting tongue (13) into the butt joint between the front end faces of the two cast iron pipes (4), said ring (12) being constructed from a softer material than the cast iron pipe (4).

6. A pipe connection according to claim 5, characterised in that the ring (12) has a T-shaped cross-section, the tongue (13) being formed by the web and the two T-limbs overlap the end sections of the corresponding inner cast iron pipes (4).

7. A pipe connection according to claim 5 or 6, characterised in that the ring (12) is manufactured from soft iron, copper or aluminium.

8. A pipe connection according to any one of the claims 5 to 7, characterised in that the ring (12) is also so constructed as to receive the sealing rings.

9. A pipe connection according to any one of the preceding claims, characterised in that the advance working pipes (2, 3) are constructed as a pre-fabricated unit made up of an inner cast iron pipe (4), an outer jacket pipe (6) and an intermediate layer (7).

10. A pipe connection according to claim 9, characterised in that the spacer ring (11), and, where applicable, a sealing ring (9), is/are integrated in the prefabricated unit at one end of the advance working pipe.

11. A pipe connection according to any one of the preceding claims, characterised in that a compartment for locating the sealing ring or rings (9, 9a), the spacer ring (11) and the floatingly positioned ring (12) is defined by means of projecting end sections of the inner cast iron pipes (4), the jacket pipes (6) and/or the intermediate layer (7), between the advance working pipes (2, 3) for connection.