

Description

The invention relates to pipe bursters.

It is known to replace existing pipes, such as distribution mains for natural gas by bursting the pipe using a pipe burster and inserting a new pipe in the passage in the ground formed by the burster. That technique is described for example in British patents Nos. 2092701 and 2169681 which also describe proposed examples of pipe bursters.

In UK patent No. 2092701 there is described a mole which has three or more blades pivotted to the mole. The blades are forced outwardly to crack a pipe by means of a hydraulically driven ram. After the pipe has been cracked, the mole is pulled forwardly through the pipe to displace the cracked pipe and surrounding earth by the tapered enlarged body to the rear of the blades.

In another embodiment the mole is driven forward by a pneumatically-powered impact mechanism, the blades remaining fixed. One blade is pivotted at the front and is acted on by a hydraulic piston and cylinder to force the blade outwardly to crack a pipe joint. Thereafter, the mole advances under the action of the impact mechanism to displace the cracked pipe and surrounding earth by the tapered enlarged body to the rear of the blades.

In neither embodiment is earth displaced by both the blade and the mole. In other words the action is as follows: first, the blades or blade is extended and then retracted; second the mole advances to displace the cracked pipe and surrounding earth. Such action requires a very high force for advancing the mole, since it has to displace cracked pipe and soil as it advances.

The object of the invention is to provide a pipe burster which displaces the cracked pipe and the surrounding earth by means of the separation of the parts about the pivot pin and then advances into the clearance thus made.

A pipe burster of the type known from GB-A-2 092 701 comprises an elongated body tapering in the lengthwise direction of the body and being made up of first and second parts extending in said direction, the parts being connected by a transverse pivot pin and the parts being separable about the pin by means of hydraulically actuated piston and cylinder means.

Such a burster is characterised, according to the invention, by the features of the characterising portion of claim 1.

One embodiment of burster will now be described by way of example with reference to the accompanying drawings in which :-

Figure 1 is a horizontal section through the upper part of the body as indicated at I-I in Figure 2, to a smaller scale;

Figure 2 is a vertical section through the complete burster, to the same scale as Figure 1,

Figure 3 is an end elevation looking at the right-hand end of Figure 2, to a larger scale;

Figures 4 to 7 are vertical sections on the lines IV-IV; V-V; VI-VI and VII-VII in Figure 2, to the same scale as used in Figure 3; and

Figure 8 is a longitudinal, vertical elevation through a modified form of burster.

The burster 10 comprises a first or lowermost part 12 and a second, uppermost part 14, both parts extending in the lengthwise direction of the burster 10. The parts 12, 14 are both shaped so as to give to the burster 10 a shape tapering in the lengthwise direction towards the front end, where an eye 16 is provided on the second part. The first part 12 is received within the second part 14, which is channel shaped where it receives the first part 12. The second part 14 has side-walls 18 between which the first part 12 is received.

The two parts 12, 14 are connected by a transverse pivot pin 20. The first part 12 has a piston-and-cylinder mechanism 22, the piston rod 24 of which bears upon the base 26 of the channel 28 in the second member 14. The piston-and-cylinder mechanism 22 comprises a cylinder 30, fitted in an aperture 32 in the second part 14, and a piston 34 slidable in the cylinder 30. The cylinder 30 has an O-ring 40. The wall of the aperture 32 carries another O-ring 42 bearing on the cylinder 30. The cylinder 30 has an O-ring 44 bearing on the piston rod 24. The piston 34 has an O-ring 46 engaging the inside of the cylinder 30 (see Figure 4).

The interior of the cylinder 30 above the piston 34 is connected to the hydraulic supply (not shown) by a passage 48 connected to a connection 50 for an hydraulic hose. The cylinder below the piston 24 is connected by a passage 52 to another connection 54. The connection 54 supplied fluid under high-pressure to force the piston 34 outwardly. The connection 50 allows fluid to be supplied to the top of the piston 34 to cause it to return inwardly.

The first part 12 has a stop surface 60, which engages with a stop surface 62 on the second part 14 at full stroke of the piston-and-cylinder mechanism 24.

Soil particles are prevented from entering channel shaped part 14 in front of the part 12 by a rubber block 68, which is compressed between the two parts immediately in front of the pivot pin 20.

The burster 10 is used for bursting a pipe e.g. a gas distribution cast iron main. Excavations are opened at each end of a length of pipe to be burst and the burster is pulled through the pipe by means of a winch cable extending through the pipe and attached to the eye 16. The burster 10, as illustrated, is intended for bursting a 4-inch (100 millimetre) nominal bore cast iron pipe. Such a pipe has a thicknesses of 0.4-inch (10mm). However, the bell and socket joints used on such mains have a maximum thickness of about

1.2-inch (38mm). The maximum force necessary to break such joints is 14 to 15 tons (140 to 150 kN). The burster has been designed to exert such a force when the pipe or joint is positioned at the second line VI-VI.

The mode of operation of the burster 10 is firstly to expand the two parts 12, 14 by extension of the piston-and-cylinder mechanism 22. This breaks the pipe or joint and displaces the cracked pipe or joint and the surrounding soil outwardly to form a clearance. Then, as the clearance is formed, the tension on the winch rope pulls the burster 10 forwardly into the clearance so formed.

Figure 8 shows a burster having three piston and cylinders 22. The first of these is at the position 70 where the piston and cylinder of the first embodiment is shown. The other two are at the positions 72 and 74 are at positions to support the bending moment imposed on the body by the pipe. In particular the piston and cylinder at the position 74 is close to or at that position. The piston and cylinder at the position 72 may be omitted in another embodiment. In Figure 8 the two members 12, 14 have ribs 80, 82 to cause concentrated forces to act on the pipe. The ribs are optional.

Both embodiments have in each side wall 18 near the lower edge a longitudinal seal engaging the member 12 in rubbing engagement. Also, a transverse seal is provided in the rear plate forming the end wall of the channel shaped part 14. This seal is located just below the stop surface 62 and engages the part 12 in rubbing engagement. These seals prevent ingress of soil particles between the parts 12, 14. The aperture in the end wall is closed by an adaptor (not shown) which provides for hydraulic connections.

Although the end wall of the channel-shaped part 14 is shown as a flat plate in the drawings it is in fact machined as a radius of curvature (centred on the centre of the pivot pin 20) at its inner face carrying the seal just referred to. The end face of the part 12 is similarly machined.

The embodiment shown in Figures 1 to 7 is preferred for the smaller sizes of pipe e.g. 4-inch (100mm). In that case, it is necessary to use a lever principle to magnify the applied forces at a pipe joint, for example, because the pipe size restricts the use of a directly-acting piston-and-cylinder device without compromising the mechanical strength of the burster.

Claims

1. A pipe burster comprising an elongated body tapering in the lengthwise direction of the body and being made up of first and second parts (12, 14) extending in said direction, the parts being connected by a transverse pivot pin (20) and the parts being separable about the pin by means of hydraulically actuated piston and cylinder means

(22) characterised in that the separation of the parts (12, 14) about the pivot pin (20) cracks the surrounding pipe and displaces the cracked pipe and the surrounding earth to make a clearance into which the burster advances without further cracking of the surrounding pipe or further displacement of the cracked pipe and the surrounding earth, the first part (12) having the piston and cylinder means (22) being received within the second part (14), which second part is of channel shape where it receives the first part (12) is received, the circumference of the body being substantially a closed curve and within the length of the first part (12) the circumference of the body is increased by said separation.

2. A burster according to Claim 1, the piston and cylinder means comprising a single piston and cylinder (22).
3. A burster according to Claim 1, the piston and cylinder means comprising more than one piston and cylinders (22).
4. A burster according to claim 3, one piston and cylinder (22) being positioned on or close to the point at which the burster first engages the unbroken pipe.

Patentansprüche

1. Gerät zum Aufbrechen von Rohrleitungen, mit einem langgestreckten Körper, der sich in Längsrichtung des Körpers verjüngt und aus ersten und zweiten Teilen (12, 14) besteht, die sich in der genannten Richtung erstrecken, wobei die Teile durch einen querverlaufenden Schwenkbolzen (20) verbunden sind und die Teile um den Bolzen mittels einer hydraulisch betätigten Kolben-Zylinder-Einrichtung (22) trennbar sind, dadurch gekennzeichnet, daß die Trennung der Teile (12, 14) um den Schwenkbolzen (20) das umgebende Rohr zerbricht und das zerbrochene Rohr sowie die umgebende Erde verdrängt, um einen Spielraum zu schaffen, in den das Aufbrechergerät ohne weiteres Zerbrechen des umgebenden Rohres oder weitere Verdrängung des zerbrochenen Rohres und der umgebenden Erde vorrückt, wobei der erste Teil (12) die Kolben-Zylinder-Einrichtung (22) aufweist und innerhalb des zweiten Teils (14) aufgenommen wird, der eine Kanalförmigkeit aufweist, wo er den ersten Teil aufnimmt, und Seitenwände hat, zwischen denen der erste Teil (12) aufgenommen wird, wobei der Umfang des Körpers im wesentlichen eine geschlossene Kurve ist und innerhalb der Länge des ersten Teils (12)



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der Umfang des Körpers durch die Trennung vergrößert wird.

2. Gerät nach Anspruch 1, bei dem die Kolben-Zylinder-Einrichtung einen einzelnen Kolben und Zylinder (22) aufweist. 5
3. Gerät nach Anspruch 1, bei dem die Kolben-Zylinder-Einrichtung mehr als einen Kolben und Zylinder (22) aufweist. 10
4. Gerät nach Anspruch 3, bei dem der eine Kolben und Zylinder (22) an oder dicht an der Stelle angeordnet ist, an der das Gerät zuerst an dem unzerbrochenen Rohr angreift. 15

Revendications

1. Eclateur de tuyaux comportant un corps allongé s'effilant dans sa direction longitudinale et constitué de première et seconde parties (12, 14) s'étendant dans ladite direction, les parties étant reliées par un axe transversal (20) de pivot et les parties pouvant être séparées autour de l'axe à l'aide d'un moyen (22) à piston et cylindre actionné hydrauliquement, caractérisé en ce que la séparation des parties (12, 14) autour de l'axe (20) de pivot fracture le tuyau entourant et déplace le tuyau fracturé et le terrain encaissant pour produire un dégagement dans lequel l'éclateur avance sans fracturation supplémentaire du tuyau entourant ou déplacement supplémentaire du tuyau fracturé et du terrain encaissant, la première partie (12) comportant le moyen (22) à piston et cylindre étant reçue dans la seconde partie (14), laquelle seconde partie est de forme en gouttière où elle reçoit la première partie et comporte des parois latérales (18) entre lesquelles la première partie (12) est reçue, la circonférence du corps étant sensiblement une courbe fermée et, à l'intérieur de la longueur de la première partie (12), la circonférence du corps étant augmentée par ladite séparation. 20
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2. Eclateur selon la revendication 1, caractérisé en ce que le moyen à piston et cylindre comporte un ensemble unique à piston et cylindre (22). 50
3. Eclateur selon la revendication 1, dans lequel le moyen à piston et cylindre comporte plus d'un ensemble à piston et cylindre (22). 55
4. Eclateur selon la revendication 3, dans lequel un ensemble à piston et cylindre (22) est placé sur le point, ou à proximité du point, auquel l'éclateur porte en premier contre le tuyau non rompu.