Title of the Invention: Pipe cutter for thermoplastic pipes

Abstract Title: Rotary pipe cutter for thermoplastic pipes

The pipe cutter comprises a static ring component to fit around an outer circumference of a thermoplastic pipe. A first frame component attaches rigidly to the static ring and a second frame component 4 is rotatably mounted to the first frame component. The first and second frame components comprise a plurality of segments which can be assembled together around the pipe without the need to access the end of the pipe. The static ring component may be a collar type re-rounder 2 which helps to prevent deformation of the thermoplastic pipe when cut.
Fig. 6
PIPE CUTTER FOR THERMOPLASTIC PIPES

Field of the Invention

[0001] The present invention relates to a pipe cutter. Particularly, although not exclusively, the invention relates to a pipe cutter for cutting thermoplastic pipes.

Background of the Invention

[0002] Over the years the use of reinforced thermoplastic plastic pipe networks to transport water and waste, gas and other substances has grown, replacing pipes of steel, iron and other materials. Known thermoplastic pipe is made from materials such as polyethylene (PE), or Polyamide – 11 and which may be reinforced with high strength synthetic fibre, such as glass, aramid or carbon. Such pipes have an advantage in applications where steel pipes may rupture or corrode, and enable faster installation times. Lengths of thermoplastic pipe can be connected together by welding, which allows fast installations techniques.

[0003] Larger size thermoplastic pipes are commercially available in internal diameters of 600mm upwards, such as 630mm, 750 mm, 900 mm, 1,050 mm, 1,200 mm, 1,500 mm, 1,800 mm, or 2,100 mm.

[0004] There has always been a necessity to cut thermoplastic pipe to size, for example at the time of construction of a pipe network or when damaged pipe requires replacement. Various types of pipe cutter devices have been proposed, such as copper pipe cutters, autocat pipe cutters, guillotine pipe cutters, hinged cutters, yoke pipe cutters or soil pipe cutters. However where it is necessary to cut large diameter plastic pipes, hand rip saws, bow saws, powered chainsaws and powered circular saws are still widely used.

[0005] In some applications, for example underground applications, thermoplastic pipes can deform due to external pressure. With the exception of guillotine pipe cutters, prior art pipe cutters are normally designed for cutting metal
pipes and non-plastics pipes which do not deform in the same way that plastics material does when the cutter is applied.

[0006] One problem with known pipe cutters is that they are not able to be fixed firmly to the pipe to be cut, and do not produce a clean cut square/ perpendicular to the main axial length of the pipe.

[0007] In addition, the operating size range of prior art pipe cutters is generally within the small to medium range of outside pipe diameters. Such known pipe cutters usually have to rotate fully around the pipe to achieve a satisfactory cut. Prior art pipe cutters for generally cannot be used for cutting large diameter thermoplastic pipes.

[0008] Another problem with prior art pipe cutters is that they cannot be easily assembled and disassembled, or cannot be fixed to work at any point along a length of pipe.

[0009] In addition to this, with prior art pipe cutters, the depth of cut cannot be easily controlled.

**Summary of the Invention**

[0010] Specific embodiments described herein aim to overcome the above problems by providing a pipe cutter device for thermoplastic pipes of very large outer diameters which have the ability to be assembled in sections around a pipe. The pipe cutter devices disclosed herein can be attached around a pipe when neither of the pipe ends are exposed.

[0011] Specific embodiments disclosed herein aim to provide a device for efficient and accurate cutting of larger sized thermoplastic pipes.

[0012] Specific embodiments disclosed herein aim to provide a pipe cutter device for thermoplastic pipes, having enhanced safety and convenience features.
[0013] According to the first aspect of the present invention, there is provided a pipe cutter for cutting thermoplastic pipes, said pipe cutter adapted to fit to a static ring component adapted to fit around an outer circumference of a thermoplastic pipe and to rigidly fix to said pipe, said pipe cutter comprising:

a first frame component capable of rigidly fitting to said static ring component; and

a second frame component for carrying a cutting tool, said second frame component being rotatably mounted on said first frame component and adapted for rotating with respect to said first frame component;

wherein said first and second frame components each comprise a plurality of segments which can be assembled together around a pipe without the need to access an end of said pipe.

[0014] Preferably, a split ring gear is turn driven around the circumference of a pipe by the spur gear via a mechanical or automated force. At the same time, the plunger type router is set to a depth to take a measured cut into the wall of the pipe on each complete cycle of the pipe, until it cuts the end of the pipe off or cuts the pipe into two sections.

[0015] The router mounting block may be secured to the split ring gear by means of grub screws and/or cap head screws. The spur gear may be fixed on an adjustable drive mounting plate.

[0016] The split ring gear is made of two half sections. The two sections may be joined together by means of at least one jointing disc. The at least one jointing disc enables the pipe cutter to be assembled around a pipe at any given point along the length of the pipe even if one individual pipe is not exposed, or both ends of the pipe are not exposed.
[0017] The split ring gear is preferably mounted onto the split ring by means of grooved rollers. This allows the split ring gear to rotate independently from the split ring.

[0018] Preferably the reounder comprises holes for attaching an adjustable drive mounting plate to the reounder.

[0019] The pipe reounder may be attached to the pipe cutter with at least one attachment lug. The at least one attachment lug may be adjusted radially by any technique known in the art, preferably with grub screws. This allows centralization of the split ring around the pipe.

[0020] In the embodiment shown, there is provided a pipe cutter assembly for thermoplastic pipes comprising a pipe cutter for thermoplastic pipes and a pipe reounder. The piper cutter comprises a split ring gear made of two half sections and joined together by means of two jointing discs, a split ring, a plunger type router, a spur gear fixed on an adjustable drive mounting plate. The split ring gear is mounted onto the split ring by means of grooved rollers. The pipe reounder is attached to the pipe cutter with attachment lugs.

[0021] In a preferred embodiment, there is provided an attachment for a collar type reounder, comprising a first annular ring plate which is attachable to the collar by a plurality of clamp devices; a second annular plate member which is rotatably attached to the first ring plate and which can rotate relative to the first ring plate; and a drive means for driving the second annular plate about a same main central axis as the first annular plate so that the second annular plate can rotate relative to the first annular plate, wherein the second annular plate carries a cutting tool configured to circumscribe around a central aperture in which a pipe to be cut is located; wherein the first annular plate comprises a first plurality of segments which are assembled together to construct said first annular plate, and the second comprises a second plurality of segments which are assembled together to construct said second annular plate, thereby enabling the first and
second annular plates to be assembled around a pipe whilst the pipe is in situ, and without the need to access an end of the pipe.

[0022] Embodiments described herein may have an advantage that the pipe cutter is not subject to being trapped due to the pipe sagging or moving while the pipe is being cut. The reason is that the pipe cutter, by virtue of its thickness in cross section, produces a wider cut groove and will cut away any waste swarf material at the relevant time as the thermoplastic pipe cutting tool is traversing around the pipe. In contrast, a saw blade is subject to being trapped by the waste swarf material as the said swarf can be melted by the generation of heat at the cutting point which adheres to the inner part of the blade where there are no teeth.

[0023] Another advantage is that the pipe cutter is attached to a clamp that is fixed to the pipe being cut, which guarantees that the start and the finish position are always the same and thus a square cut is achieved, which is important for achieving good joint integrity for electrofusion.

[0024] Another advantage is that the pipe cutter for thermoplastic pipes has the ability to cut a section out of the pipe that is installed in a trench; it can be used to cut a pipe to a given length or trim and square the end of a pipe by removing a minimum amount of material if required.

[0025] Another advantage is that the pipe cutter for thermoplastic pipes has longer lifetime when compared with a circular sewing device.

[0026] Another advantage is that the pipe cutter for thermoplastic pipes does not clog up due to shavings from the cut.

[0027] Another advantage is that the pipe cutter for thermoplastic pipes does not generate excess heat at the point of cut. Excess heat melts the plastic shavings, heat is wasted in the cut channel keeping the cut cool.
[0028] Another advantage is that the feed around the pipe is controlled at all times.

[0029] Another advantage is that the pipe cutter for thermoplastic pipes is safe to use as it is not based on a circular power saw.

[0030] Another advantage is that the pipe cutter for thermoplastic pipes collects most of its own swarf preventing pollution.

[0031] Another advantage is that the mounting block has a re-rounding action on the pipe and so makes the cut more accurate.

[0032] Another advantage is that due to the fact that the cut is being produced by the plunger type router rather than a circular saw, the length and rotational axis of the router cutter prevents itself from being trapped.

[0033] Another advantage is that the depth of the router channel can be controlled by adjusting the depth of the plunger type router and making multiple passes thereby reducing the strain on the router motor.

[0034] Another advantage is that the drive around the pipe can be provided automatically by an electric motor or manually. It can be provided by a drive ratchet fixed on the adjustable mounting plate, where the spur gear can be fixed, to the plate, also a brake can be fixed which prevents backlash and runaway.

[0035] Another advantage is that the pipe cutter is not limited in the size of the pipe which it can cut. It can be used for a smaller as well as larger diameter size pipes. Preferably, it is used for larger diameter size pipes.

[0036] Another advantage is that trench working space around the pipe cutter device for thermoplastic pipes is kept at a minimum.
[0037] Other aspects are as set out in the claims herein.

**Brief Description of the Drawings**

[0038] For a better understanding of the invention and to show how the same may be carried into effect, there will now be described by way of example only, specific embodiments, methods and processes according to the present invention with reference to the accompanying drawings in which:

Figure 1 herein illustrates schematically a pipe-cutter device for cutting thermoplastic pipes in a first perspective view;

Figure 2 herein illustrates schematically the pipe cutter device in a second perspective view;

Figure 3 herein illustrates schematically a pipe re-rounder component of the pipe cutting device;

Figure 4 herein illustrates schematically a cutting tool mounting plate comprising the pipe cutter device;

Figure 5 herein illustrates schematically a toothed split ring mounting plate comprising the pipe cutter device;

Figure 6 herein illustrates schematically an adjustable drive mounting plate with a spur gear;

Figure 7 illustrates a pipe router tool for cutting thermoplastic pipes; and

Figure 8 herein illustrates a mounting block for mounting the router;

Figure 9 herein illustrates schematically the pipe cutting device in perspective exploded view;
Figure 10 herein illustrates schematically the pipe cutter device in view from one side;

Figure 11 herein illustrates schematically the pipe cutter device in view from one end;

Figure 12 herein illustrates schematically the pipe cutter device in view from the other side; and

Figure 13 herein illustrates schematically the pipe cutting device in view from above.

**Detailed Description of the Embodiments**

[0039] There will now be described by way of example a specific mode contemplated by the inventors. In the following description numerous specific details are set forth in order to provide a thorough understanding. It will be apparent however, to one skilled in the art, that the present invention may be practiced without limitation to these specific details. In other instances, well known methods and structures have not been described in detail so as not to unnecessarily obscure the description.

[0040] There will now be described several different embodiments and variations of a pipe cutter for thermoplastic pipes and a pipe cutter device for thermoplastic pipes.

[0041] Referring to figure 1 herein, there is illustrated schematically in first perspective view from one end and a first side, a pipe cutter assembly according to a specific embodiment of the present invention. The pipe cutter assembly 1 comprises a pipe re-rounder 2 which fits around an outer circumference of a pipe; a mounting plate 3 which is fixedly mounted to the pipe re-rounder; a rotatable cutter plate 4 which rotates relative to the mounting plate and the pipe re rounder
about a main central axis of the pipe re-rounder; a router tool 5 mounted to the mounting plate, which is able to traverse around an outer circumference of the pipe so as to make a circular incision around an outer circumference of the pipe; and a drive mechanism 6 which drives the rotatable cutting plate in clockwise or counterclockwise rotation relative to the pipe reounder and mounting plate.

[0042] Referring to figure 2 herein, there is illustrated schematically the pipe cutter assembly 1 in a second perspective view from one end and a second side.

[0043] In use, the pipe reounder 2 is clamps rigidly around the outside of a nominally circular cylindrical pipe with the two sections held together by the latch, and tightened using an hydraulic piston. The mounting plate 3 is rigidly attached to the pipe reounder, and the rotatable cutter plate 4 is rotationally movable with respect to the pipe reounder, which itself is static with respect to the pipe, so that the pipe cutter held on the rotatable cutter plate rotates around an outer surface of the nominally cylindrical pipe.

[0044] The mounting plate 3 comprises a track extending around its outer perimeter, and the rotatable cutter plate 4 comprises a plurality of rollers which engage with said peripheral track on said first frame member, so that the plurality of rollers travel around the outside of the mounting plate 3 on the peripheral track, thereby allowing the cutter plate 4 to rotate relative to the mounting plate 3.

[0045] Referring to figure 3 herein, the known re-rounding device 2 comprises an externally reinforced circular cylindrical split ring 7 having first and second ring pieces. Each ring piece comprises a circular cylindrical plate segment 8, 9 respectively, such that the two segments together circumnavigate a complete circle. Each plate segment 8, 9 is reinforced on its outer surface by first and second external strengthening plates 10, 11 and 12, 13. The external strengthening plates extend in a plane perpendicular to the main central axis of the inner substantially circular cylindrical surfaces of the plates. The external
strengthening plates are connected by a plurality of radially extending connector plate members 14, each connector plate member being rigidly connected to a pair of said external strengthening plates, for example by welding, and each external connector plate extending in a plane which passes through, or close to the main central cylindrical axis of the re-rounder.

[0046] In use, the pipe re-rounder is fitted around a section of exposed thermoplastic pipe and the two sections of the pipe rounder are connected by a latch mechanism 15. Connected to the latch mechanism is a hydraulic piston 16 which, under applied hydraulic pressure connected via hydraulic connector 17, draws the opposing ends of the two re-rounding segments together, thereby tightening the re-rounding so that the internal surfaces of the re-rounder form a nominally perfect circular cylindrical surface. By tightening the pipe re-rounding around a section of thermoplastic pipe, if the pipe has been compressed, such that its nominally circular cylindrical shape is distorted, the pipe re-rounding will restore the pipe to a nominally perfect circular cylindrical shape, at least for the section of the pipe which is covered by the pipe re-rounding, and for a few centimetres either side of the pipe re-rounding in the axial direction along the length of the pipe.

[0047] Referring to figure 4 herein, there is illustrated schematically in perspective view the mounting plate 3 of the pipe cutter device. The mounting plate 3 comprises a plurality of annular ring segments 18 - 21, which when connected together at their ends forms a complete circular annular ring plate. In the example shown, there are four individual segments, however in the general case there need be as few as two separate segment, to enable the mounting plate to be positioned around a circular pipe without the need to slide the mounting ring over an end of the circular pipe.

[0048] Each of the segments is connectable to its adjacent neighbouring segment by a connector member 24 - 25, in the embodiment shown, each connecting member being in the form of a jointing disc comprising a plate having a
plurality of apertures through which screws or bolts may be fitted so as to fit the plate to a set of corresponding apertures in the end of each mounting plate ring segment 18 - 21 to connect the ends of the segments together to form a complete mounting ring.

[0049] The mounting plate ring 3 is attached to the pipe re-rounder by a plurality of attachment lugs 26. The attachment lugs may be attached to the mounting plate segments at any of a plurality of apertures in the mounting ring, located at positions around the mounting ring as shown in figure 4. Each attachment lug 26 is attached to a corresponding mounting ring segment by a screw or bolt passed through the mounting ring and into a tapped thread on the attachment lug.

[0050] Each attachment lug has a slot which faces with its open end facing radially inwardly towards the main central axis of the mounting ring. In use, the attachment lugs attach to the peripherally extending strengthening plates on one end of the pipe re-rounder, so that the mounting plate can be fitted projecting from the pipe re-rounder at either end of the pipe re-rounder as shown in the exploded view of figure 9 herein. Once the re rounder is in place on the pipe, the mounting plate can be fitted to the re rounder at either one or the other end of the re rounder, so that a cut to the pipe can be made either end of the re rounder.

[0051] The attachment to lugs are secured to the strengthening plate of the re-rounder by tightening a plurality of grub screws 35 in an axial direction, clamping the lug to the strengthening plate. The mounting plate 3 which forms a frame around the pipe, may be centralized so that its main central axis coincides with the main central axis of the pipe by adjusting a further set of grub screws 36 which extend in the radial direction through the attachment lugs and which bear upon a perimeter of the strengthening plates around the re-rounder.
The mounting plate itself 3 has a radially outwardly extending convex “V” shaped periphery 27, which acts as a running or bearing surface on which the rotatable cutter plate travels.

Referring to figure 5 herein, the rotatable cutter plate 4 is in the form of a ring gear plate and comprises a plurality of separate plate segments 28, 29, in the embodiment shown there being two segments comprising a first split ring gear plate segment 28 and the second split ring gear plate segment 29. Ring gear plate segment comprises a substantially flat annular plate segment having a radially outwardly extending gear-toothed periphery 30. The ring gear plate 4 is provided with a plurality of roller wheels 31, each having its main plane offset in the main axial direction, to the side of the split ring gear plate. Each roller has an outer periphery comprising a concave “V” shaped groove circumnavigating the outside of the roller wheel, and having a cross section shape opposite to the substantially “V” shaped rim of the mounting plate 3. The concave “V” shaped rim allows the roller to seat, in use, on the circular outer peripheral rim of the mounting plate 3. In use, the rollers engage with an outer peripheral rim of the mounting plate 29. The concave “V” shaped peripheries of the roller wheels 31 engage with the convex “V” shaped outer rim of the mounting plate to make sure that the gear ring 4 rotates in a plane parallel to the main plane of the mounting plate and in a plane perpendicular to a main axial direction of the pipe, thereby giving a cut which is in a plane perpendicular to the main axial length of the pipe.

Each roller 31 is spaced apart from the gearing plate 4 in the axial direction, so that the gear ring plate can move in a plane which is parallel to a plane of the mounting plate 3.

Also shown in figure 5 are a plurality of apertures 32 in the gear ring plates which are provided to lighten the plate segments. The plurality of gearing segments 28, 29 are joined together at their respective opposing ends by first and second jointing plates 33, 34. Each jointing plate comprises a flat plate of metal having a plurality of through holes through which a set of screws may be
fitted. The screws engage in a corresponding set of drilled and tapped apertures near the ends of the ring plate segments to join the joining plates to the ring segments at their ends, and to thereby create a full circular annular gear ring plate.

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[0056] Referring to figure 6 herein, there is illustrated schematically in perspective view a drive mechanism assembly 6 comprising a first plate 601; a second plate 602; a spur gear 603 mounted on a rotating axle 604; and a ratchet lever 605 which can be pulled to rotate the spur gear 603. The axle is mounted to the second plate 602 by a pair of mounting brackets 606, 607 each of which contains a bearing. The axle passes through nylon block 608 which acts as a brake to prevent backlash and runaway of the rotating geared plate as it rotates around the pipe. The first plate of the drive mechanism is provided with one or more curved back plates 609 having a through aperture, through which a bolts can be passed in order to attach the drive mechanism to the strengthening plates of the re-rounder, thereby rigidly mounting the drive mechanism to the re-rounder in a position where the spur gear 603 engages with the peripheral gear teeth 30 of the gear ring plate 4.

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[0057] The axle may have a conventional square female socket drive at one end, allowing a conventional ratchet tool 605 to be used as the ratchet lever. By pulling or pushing the ratchet lever 605, this rotates the spur gear 603 in a single clockwise or anticlockwise direction, depending upon which way the ratchet lever is set.

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[0058] The pipe re-rounder comprises a plurality of holes for attaching the adjustable drive mounting plate to said pipe re-rounder.

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[0059] Referring to figure 7 herein, there is illustrated schematically a router 5. The router 5 comprises a housing 701, a cutting tool 702, a depth adjustment lever 703; a base plate 704; and a pair of pillars 705, 706. The housing 701 is spaced apart from the base plate 704 by the pair of pillars 705, 706 on
which the housing 701 can slide up and down in a direction radially from the axial centre line of the pipe cutting tool. The router comprises a small electric motor within housing 5 which rotates the cutting tool so as to rout out a section of pipe wall as the router circumnavigates the pipe.

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[0060] The base 704 of the router tool is rigidly mounted to the rotatable gear ring by a router mounting block as shown in figure 8 herein. The cutting tip edge of the router projects through the base 704, and radially inwardly towards the axial centre line of the pipe. The depth of the cutting tool 702 can be varied by adjusting the lever 703 which slides the housing up and down the pillars 705, 706.

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[0061] Referring to figure 8 herein, there is illustrated schematically in perspective view the router mounting block 800. The router mounting block mounts the router device to the gear ring plate, using first and second screws or bolts 801, 802. Connection of the router mounting block to the annular gear plate is as shown in figure 1 herein. The router mounting block comprises a rigid block 803 having a substantially rectangular shape, and having protruding therefrom, and elongate rectangular slot housing 804. Attached to the rigid block 803 are first and second rods 805, 806 extending therefrom. The slot housing 804 extends along a main plane of the rigid block 803 and comprises an internal slot 807 for guiding a projecting pin 808, in use, in a direction radially towards or away from a main central pipe axis.

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[0062] As shown in figure 1 herein, the router attaches to the router mounting block 800 by sliding the base plate member 704 of the router onto the pair of pins or rods 805, 806 extending from the mounting block. This allows the router to move in a direction parallel to a main central axis of the pipe, whilst still holding the cutting tool in a direction radially to the pipe. The lever 703 which sets the depth of cut of the cutting tool is attached to the protruding pin 808 which can slide in a direction radially to the pipe in a slot 807 of the guide housing 804.
[0063] Referring to figure 9 herein, there is illustrated schematically the pipe cutting device in exploded view, showing the reounder device 2, the mounting ring plate 3, the rotating geared ring plate 4, the router device 5, the router mounting block 800, and the drive mechanism 6.

[0064] Referring to figure 10 herein, there is illustrated schematically in view from one side, the pipe cutting device of figure 1 herein.

[0065] Referring to figure 11 herein there is illustrated schematically the pipe cutting device in view from one end.

[0066] Referring to figure 12 herein, there is illustrated schematically the pipe cutting device of figure 1 herein in view from the other side.

[0067] Referring to figure 13 herein, there is illustrated schematically the pipe cutting device in view from above, showing the connection between the opposing ends of the reounder segments, and how the reounder segments are pulled together using the hydraulic piston 28.

Fitting the Pipe Cutting Device to the Pipe

[0068] An example of fitting of the pipe cutting device to a pipe will now be described. If the pipe is an underground pipe, it may be necessary to excavate earth above, around and underneath a length of the pipe, to give enough room for the pipe cutter device to be fitted around the pipe, and for the router 5 to rotate around the pipe. There needs to be enough free space immediately adjacent the pipe both in the radial direction and the axial direction to enable fitment and removal of the pipe cutter device.

[0069] Once a length of the pipe is exposed, the reounder component 2 as shown in figure 3 herein is fitted around the outside surface of the pipe. The two segments of the reounder are hingedly connected to each other and swing open wide enough to be able to fit around the outer diameter of the pipe. Once
loosely fitted around the pipe, the two adjacent ends of the segments of the re-rounder are latched together using latch 15. Once latched together, the re-rounder can be tightened around the pipe so that it cannot move rotationally with respect to the pipe due to the friction between the inner surfaces of the re-rounder segments, and the outer surface of the pipe.

[0070] Tightening of the two re-rounders is by application of hydraulic pressure to the hydraulic piston 16 via hydraulic pressure connector 17. Tightening of the pipe re-rounders against the pipe outer surface not only rigidly secures the pipe re-rounders to the pipe so that it cannot rotate with respect to the pipe, but also serves to restore a localised section of the pipe to a nominally circular cylindrical cross-section in the vicinity of the re-rounders, if for any reason the pipe has become deformed.

[0071] The plurality of mounting plate segments are arranged around the circumference of the pipe and attached to the re-rounders, such that their locating lugs 26 and engage with the external circumferential strengthening plates 10 -13 adjacent the end of the re-rounders to which the strengthening plates are being fitted. The mounting plate can be fitted on either end of the re-rounders, either to the left of the re-rounders or to the right of the re-rounders as viewed by a person fitting the pipe cutter device to a pipe.

[0072] Grub screws 35 are used to clamp the attachment lugs 26 to the annular radially extending strengthening plate extending around the re-rounders. The adjacent opposing ends of the segments of the mounting plate are joined together using the connecting members 22 - 25.

[0073] The attachment lugs may be adjusted radially with a further set of grub screws which extend in the radial direction to centralize the mounting plate with respect to the pipe re-rounders.
With the mounting plate in place, the rotatable split ring gear can be fitted to the mounting plate. The split ring gear segments 28, 29 are assembled to each other, and around the pipe, ensuring that the concave “V” shaped grooves of the peripheral roller wheels 31 engage with the peripheral convex “V” shaped rim of the mounting plate, so that the periphery of the mounting plate forms a track around which the rollers of the gear ring travel on, running around the edge of the mounting plate. The gear teeth 30 around the edge of the cutting plate engage with the gear teeth of the spur gear 603. The ends of the two split ring gear segments are joined to each other using the gear ring jointing plates 33, 34.

**Cutting Operation**

An example of a cutting operation using the pipe cutting device will now be described. With the pipe cutting device assembled and attached to the pipe, the pipe may be cut by rotating the gear ring cutting plate 4 relative to the mounting plate and re-rounder using the drive assembly as shown in figure 6. Pulling of the ratchet lever 605 causes the spur gear 603 to rotate, thereby driving the gear ring rotationally relative to the mounting plate and re-rounder. This causes the router to circumnavigate the outside of the pipe, and the tip of the cutting tool 702 to engage with the material of the pipe, scoring out a channel in the pipe wall.

If the direction of cut is to be reversed, this can be effected by changing the direction setting at the base of the ratchet lever 605 in order to reverse the direction in which the ratchet lever drives the axle connected to the spur gear 603. Therefore, using the ratchet lever, the gearing can be driven either in a clockwise or anticlockwise direction, selectable by a person operating the pipe cutting device.

The amount of control of cutting depth provided by the adjustable lever 703 on the router is finely adjustable so that each full revolution of the cutting tool around a circumference of the pipe may take a small sliver of material, thereby enabling the cutting tool to cut through the pipe through several rotations.
around the circumference of the pipe, each rotation making a small depth of cut until the router has fully cut through the pipe wall. Consequently, a neat cut in a plane perpendicular to a main central axis of the pipe may be made without causing any distortion of the edge of the cut end of the pipe.

[0078] During cutting, the geared ring 4 driven by the spur gear 603 is rotated only a small distance at a time, commensurate with the amount of rotation of the spur gear by a single pull of the ratchet lever. The gear frame 4 is prevented from overrunning or returning in the opposite direction by the nylon brake block 607, 608 thereby allowing accurate control of the cutting operation by the user.

[0079] The nylon brake block 607, 608 operates to inhibit free movement of the spur geared frame when the ratchet lever is not being operated, and to provide a minimum amount of resistance to movement of the ratchet lever, thereby enabling an operator to exert greater control over movement of the cutting tool and to control movement of the cutting tool in the circumferential direction.

[0080] The pipe cutter device disclosed herein may provide a means for cutting a known thermoplastic pipe which may have been subject to compression forces in use and therefore may have deviated from its nominal circular cylindrical form at the point of manufacture, by firstly providing a hydraulically operated re-rounding of the pipe, to restore a length of the pipe in the immediate vicinity of the re-rounder to a more accurately circular cylindrical shape, and by providing cutting of the pipe by successive circumnavigations of the perimeter of the pipe in one or more revolutions around the pipe.

[0081] The pipe cutter device can be fitted around a length of pipe without the need to access an end of the pipe. There is no need to pass the fully assembled cutting device over an exposed end of a pipe to be cut. Rather, the rerouting, mounting ring and toothed cutting plate ring 4 can each fit over the outer circumference of the pipe or be assembled around the pipe without the need to access an end of the pipe.
[0082] The amount of space required either side of the pipe is minimised through the use of a pipe cutter device which has a minimum radial distance from an inward facing surface of the pipe cutter to a radial outer extremity of the pipe cutter. In the best mode, the overall thickness dimension of the pipe cutter in the radial direction as measured from the inner surfaces of the re-rounder to the outer extremity of the router 5 is in the range 7 to 16 cm, which minimises the amount of excavation around the pipe which needs to be made in order to fit the pipe cutting assembly around a pipe in situ.

[0083] The pipe cutter device has the advantage of being suitable for cutting large diameter thermoplastic pipes. Typical large diameter thermoplastic pipes having an outside diameter of 600mm upwards may be accurately and reliably cut using the pipe cutter device disclosed herein. In the embodiments disclosed herein, when used for a large diameter pipe, the radial thickness of the pipe cutter assembly is small compared to the inner radius of the pipe being cut. For example, when using a pipe of inner bore diameter 600mm, the radial thickness of the pipe cutter assembly is typically no more than 160mm, and so the additional clearance space needed around the pipe for a complete circumnavigation of the pipe is 920mm. This means that the pipe cutter assembly can be fitted and operated within a trench of width 920mm or more.

[0084] In the general case, for pipes having an inside diameter of 600 mm or greater, the radial dimension of the pipe cutter assembly on one side is no more than 27% of the inside diameter of the pipe being cut.

[0085] In an alternative embodiment, a pipe cutter device is substantially as herein described, with the exception that the drive mechanism comprises a small electric motor instead of a manual ratchet. The electric motor can be driven by a low voltage power supply, for example a 12 volt battery. Provision of electric motor drive to the drive mechanism and to the motor of the router may allow for
computerised control of the power supply to the motors and therefore
computerised control of the pipe cutting operation.
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Claims

1. A pipe cutter for cutting thermoplastic pipes, said pipe cutter adapted to fit to a static ring component adapted to fit around an outer circumference of a thermoplastic pipe and to rigidly fix to said pipe, said pipe cutter comprising:

   a first frame component capable of rigidly fitting to said static ring component; and

   a second frame component for carrying a cutting tool, said second frame component being rotatably mounted on said first frame component and adapted for rotating with respect to said first frame component;

   wherein said first and second frame components each comprise a plurality of segments which can be assembled together around a pipe without the need to access an end of said pipe.

2. The pipe cutter as claimed in claim 1, capable of being attached to a said collar which fits securely around an outer surface of said thermoplastic pipe.

3. The pipe cutter as claimed in claim 1 or 2, capable of being attached to a collar type re-rounder, which fits securely around an outer surface of said thermoplastic pipe.

4. The pipe cutter as claimed in any one of the preceding claims, further comprising a cutting tool which attaches to said second frame component, so that as said second frame component rotates relative to said first frame component, said cutting tool circumnavigates around a central aperture of said first and second frame components.
5. The pipe cutter as claimed in claim 4, wherein said cutting tool is fitted to said second frame component such that it is capable of extending or retracting in a radial direction relative to a main central axis of rotation of said second frame component.

6. The pipe cutter as claimed in any one of the preceding claims, wherein said first frame member is provided with a plurality of attachment lugs for attaching to said static collar.

7. The pipe cutter as claimed in any one of the preceding claims, wherein said first frame component comprises a plurality of annular plate segments which can be attached together end-to-end to form an annular circular plate.

8. The pipe cutter as claimed in any one of the preceding claims, wherein said second frame component comprises a plurality of annular plate segments which can be attached together end-to-end to form an annular circular plate.

9. The pipe cutter as claimed in any one of the preceding claims, wherein said first frame member comprises a track extending around a perimeter of said first frame member, and said second frame member comprises a plurality of rollers which engage with said peripheral track on said first frame member.

10. The pipe cutter as claimed in any one of the preceding claims, wherein said second frame member comprises a set of gear teeth extending around said second frame member.

11. The pipe cutter as claimed in any one of the preceding claims, further comprising a drive means for urging said second frame component to rotate relative to said first frame component.
12. The pipe cutter as claimed in claim 11, wherein said drive means is adapted to be rigidly mountable to a collar type re-rounder device.

13. The pipe cutter as claimed in claim 11 or 12 wherein said drive means comprises a ratchet driven spur gear which engages with said second frame component and is capable of rotating said second frame component either in a clockwise or an anticlockwise manner.

14. The pipe cutter as claimed in any one of the preceding claims, wherein said first and second frame components are capable of being attached to either a first end or a second end of said static collar component.

15. The pipe cutter as claimed in any one of the preceding claims, wherein said first and second frame members in assembled form have an internal aperture diameter of 600 mm or greater.

16. A pipe cutter for cutting thermoplastic pipes, said pipe cutter adapted to fit to a collar type re-rounder which attaches securely to an outer surface of a said thermoplastic pipe, said pipe cutter comprising:

   a first frame component adapted to fit to said re-rounder, such that said thermoplastic pipe extends through a central aperture of said first frame component;

   a second frame component adapted to mount to said first frame component such that said second frame component can rotate relative to said first frame component;

   a cutting tool mountable to said second frame component such that as said second frame component rotates around said first frame component, said cutting tool cuts into a wall of said thermoplastic pipe; and
a drive means for driving said second frame component in rotational movement relative to said first frame component;

wherein said re-rounder, said first frame component and said second frame component are constructed so as to be able to be assembled around a said thermoplastics pipe from a position at a side of said pipe, without the need to access an end of said pipe.

17. The pipe cutter as claimed in claim 16, wherein said drive means comprises a ratchet driven rotatable shaft capable of being rigidly attached to said pipe re-rounder.

18. The pipe cutter as claimed in claim 16 or 17, wherein said drive means is manually operable.

19. The pipe cutter as claimed in any one of claims 16 to 18, wherein said second frame component comprises a plurality of annular plate segments, capable of being connected together to form a rigid annular ring extending around a central aperture through which a said thermoplastic pipe may pass.

20. The pipe cutter as claimed in any one of claims 16 to 19, wherein said first frame component comprises a plurality of annular plate segments capable of being assembled around an outer circumference of a thermoplastic pipe and being capable of rigidly connected together to form an annular ring around a central aperture through which a said thermoplastic pipe may pass.

21. The pipe cutter as claimed in any one of claims 16 to 20, wherein said cutting tool is mountable to said second frame component such that it may circumnavigate around a thermoplastic pipe passing through said central aperture of said second frame component, thereby cutting a circular groove in a wall of said pipe.
22. The pipe cutter as claimed in any one of claims 16 to 21, wherein said cutting tool is spring mounted in a housing, said housing being rigidly fixed to said second frame component, such that said spring urges a tip of said cutting tool radially inwardly.

23. The pipe cutter as claimed in any one of claims 16 to 22, wherein said drive means comprises a spur gear and said second frame component comprises a circular gear track which engages with said spur gear.

24. The pipe cutter as claimed in any one of claims 16 to 23, wherein said drive means comprises a brake which acts to inhibit free rotation of said second frame member around said first frame member.

25. The pipe cutter as claimed in any one of claims 16 to 24, wherein said first frame member is securely attachable to a said pipe re-rounder by a plurality of engagement lugs, each having a slot which engages around an external flange member of said pipe re-rounder, so as to rigidly secure said first mounting plate to said pipe re-rounder.

26. The pipe cutter as claimed in any one of claims 16 to 25, wherein said cutting tool mounted to said second component is being capable of extending or retracting in a radial direction relative to a main central axis of rotation of said second component.

27. The pipe cutter as claimed in any one of claims 16 to 25, comprising a spur gear fixed on an adjustable drive mounting plate.

28. The pipe cutter as claimed in any one of claims 16 to 27, wherein said second frame comprises a split ring gear made of two half sections.

29. The pipe cutter as claimed in claim 28, wherein the two half sections are joined together by means of at least one jointing disc.
Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

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<th>Category</th>
<th>Relevant to claims</th>
<th>Identity of document and passage or figure of particular relevance</th>
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<td>X</td>
<td>1-29</td>
<td>WO 93/13901 A1 (BLUECHER) See figures and abstract.</td>
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<td>A</td>
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<td>US 3807047 A (SHERER et al.) See figures and abstract.</td>
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Categories:

| X       | Document indicating lack of novelty or inventive step |
| Y       | Document indicating lack of inventive step if combined with one or more other documents of same category. |
| &       | Member of the same patent family                     |
| A       | Document indicating technological background and/or state of the art. |
| P       | Document published on or after the declared priority date but before the filing date of this invention. |
| E       | Patent document published on or after, but with priority date earlier than, the filing date of this application. |

Field of Search:
Search of GB, EP, WO & US patent documents classified in the following areas of the UKC:

Worldwide search of patent documents classified in the following areas of the IPC:
B23B; B23D; B26D

The following online and other databases have been used in the preparation of this search report:

EPODOC, WPI

International Classification:

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