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Arnot

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[54] DEVICE FOR WORKING A CYLINDRICAL WORK-PIECE

[72] Inventor: Alfred Erwin Reginald Arnot, The Bell
House, Baughurst, Basingstoke,
Hampshire, England

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82/101

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90

[56] References Cited

UNITED STATES PATENTS

178,617 6/1876 Evarts.....30/94

1,431,546 10/1922 Servais.....30/94
3,253,336 5/1966 Brown30/98

Primary Examiner—Andrew R. Juhasz

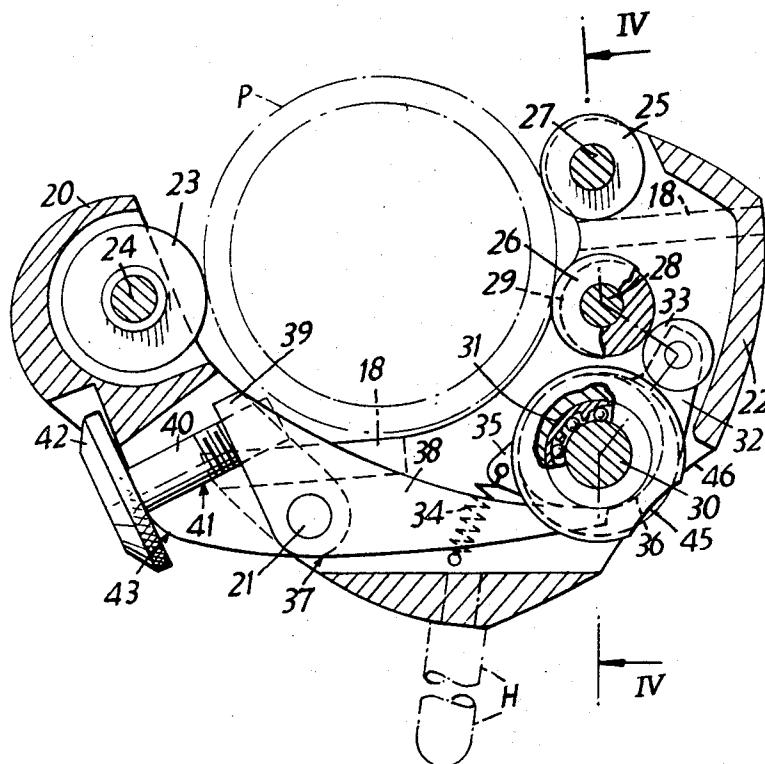
Assistant Examiner—Gary L. Smith

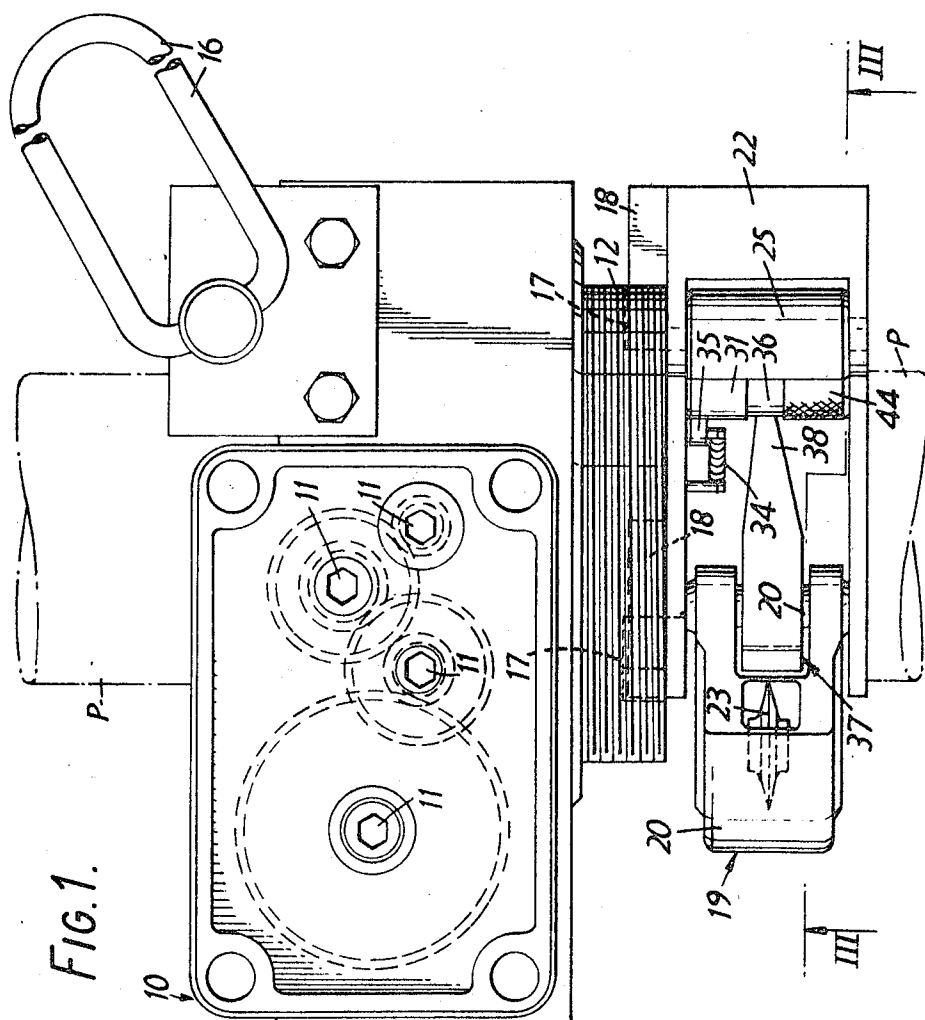
Attorney—William D. Hall, Elliott I. Pollock, Fred C. Philpitt,
George Vande Sande, Charles F. Steininger and Robert R.
Priddy

[57] ABSTRACT

A pipe cutter or the like, comprising a frame carrying a movable cutting tool; rollers mounted on the frame to engage the pipe, and one of said rollers being driven by rotation of the cutter relative to the pipe; and a drive arrangement operated by the driven roller to feed the cutting tool radially into the pipe material as the cutter revolves relatively around the pipe. The drive which feeds the tool includes a one-way clutch device and a manually-operated adjustor is provided to reset the cutting tool prior to the start of a cutting operation.

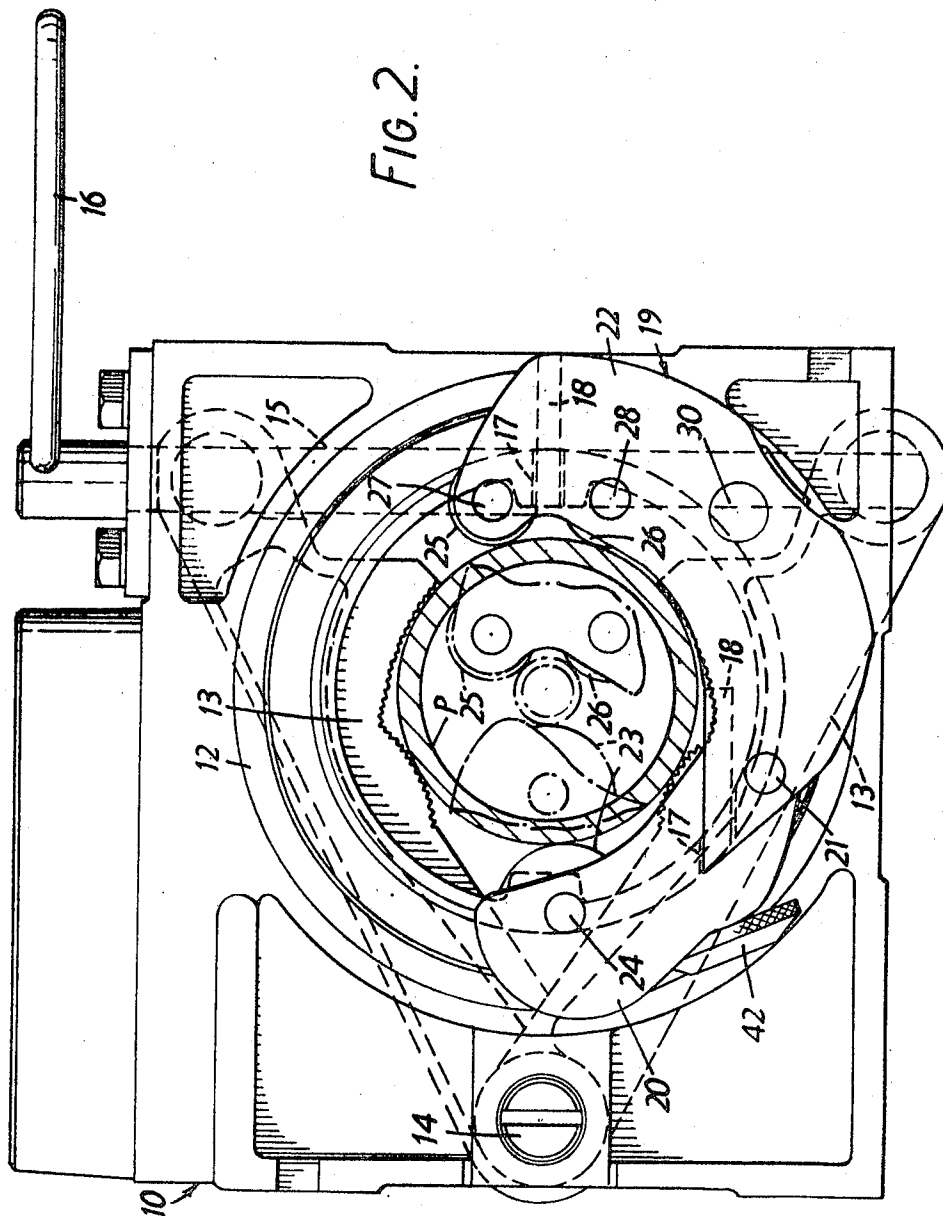
24 Claims, 5 Drawing Figures





Alfred E.R. Arndt
Inventor

by Hall, Pollock & Vande Sande
Attorneys



Alfred E.R. Arnot
Inventor

by Hall, Pollock & Vande Sardo
Attorneys

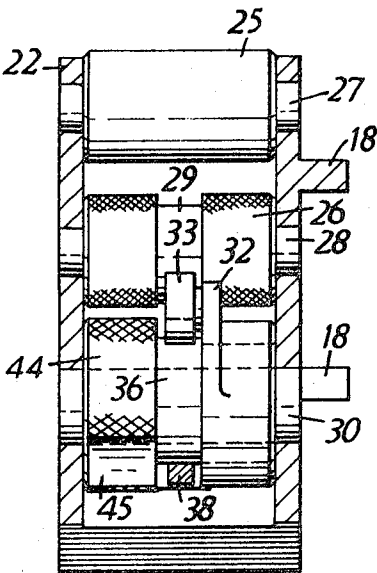
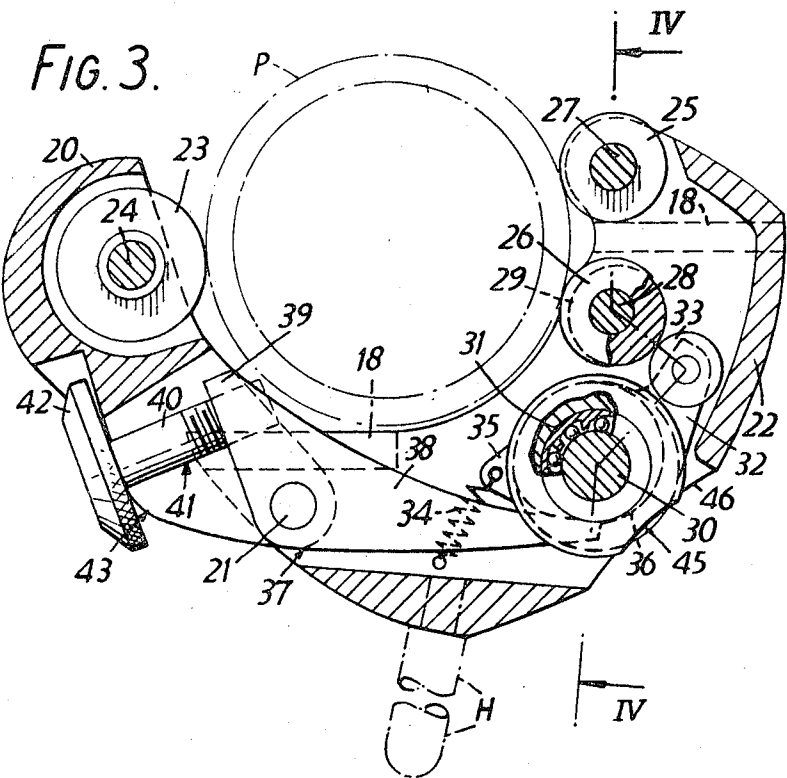
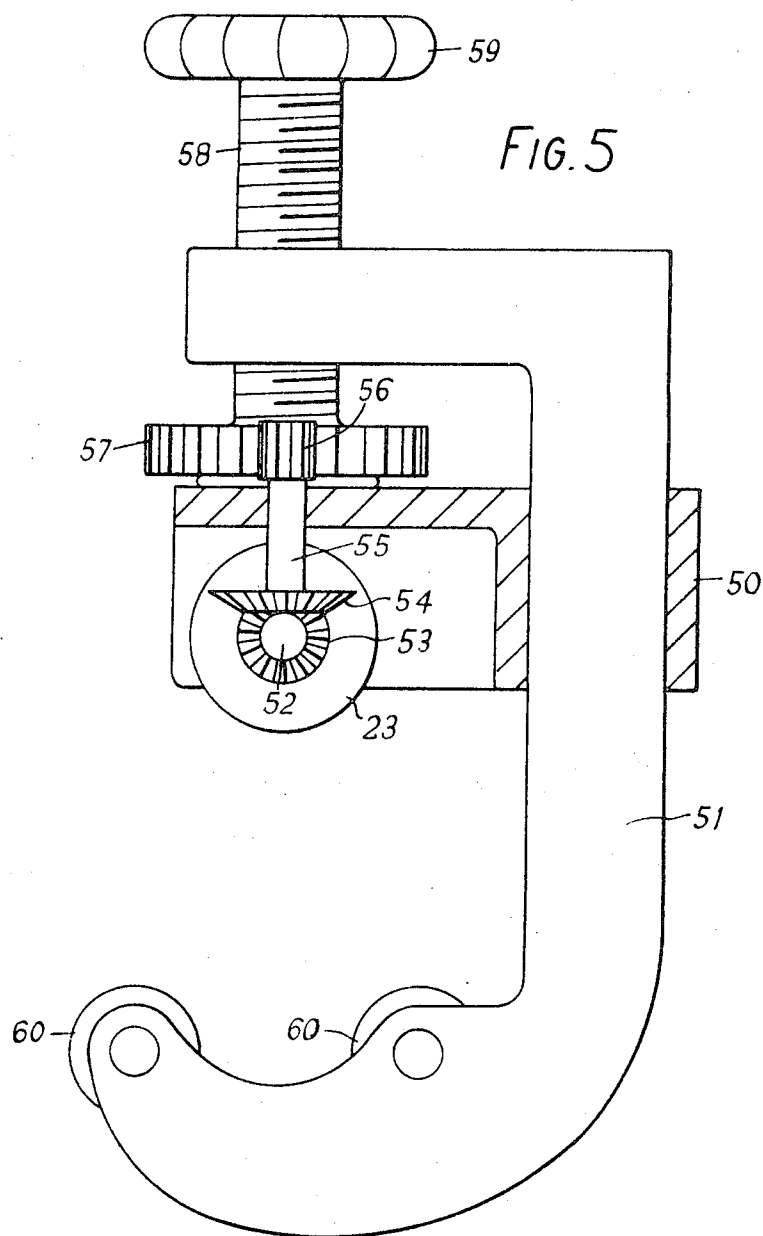


FIG. 4.

Alfred E.R. Arnot
Inventor
by Hall, Pollock & Vande Sande
Attorneys.



Alfred Edwin Reginald Hirst
Inventor

by *Alfred E. Hirst* Attorney

DEVICE FOR WORKING A CYLINDRICAL WORK-PIECE

BACKGROUND OF THE INVENTION

This invention relates to a device for working cylindrical work-pieces; the invention has particular application to metal pipe cutting, and one device according to the present invention is specifically intended for use with the portable tool accessory described in my copending Patent application Ser. No. 524,342, now U.S. Pat. No. 3,453,673 issued July 8, 1969, for "Tools."

Pipe cutting apparatus is well known which comprises three or more wheels, at least one of which is a cutting wheel, the whole assembly being adapted to be rotated around a pipe while the cutting wheel is fed radially inwards by hand. Such apparatus is convenient for use on freely accessible stationary pipes when the cutter is manually rotated and may be frequently stopped to make adjustments, or in cases where the pipe is rotated by power means and the cutter is held stationary so that continuous manual feed may be applied to the cutting wheel. However, in a system in which the pipe is held stationary and the cutter is rotated by power means, no satisfactory method for feeding the cutter has heretofore been available.

It is an object of the present invention to provide a pipe cutter or the like in which the above disadvantage is at least partially overcome.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided a device for working a cylindrical work-piece, comprising a frame, work-piece bearing means carried by the frame, a tool holder mounted on said frame and arranged to carry a tool for working said work-piece, and feeding means arranged to derive a drive from relative rotation between said work-piece and said device to effect feeding movement between said tool and said work-piece.

A device according to the invention is particularly suitable for cutting pipes and may be arranged to cut inwards from outside the pipe, or outwards from inside the pipe; the cutting means may comprise a single-point or form tool, or a free-running cutter wheel, or a rotary or reciprocating driven toothed cutter or abrasive wheel or the like. Alternatively, the device may be provided with a grooving tool for forming internal or external grooves or with a swaging tool for forming internal or external corrugations or flanges.

In a preferred construction, at least one roller is mounted on said frame and said feed means are driven by that roller to feed said tool holder towards said work-piece.

The above-mentioned roller, or alternatively a cutting wheel, may actuate the feed means through a cam, gear, screw, hydraulic, or friction drive, and the feed means may comprise manual or automatic compensating means to adjust the tool feed rate in accordance with the size or nature of the work-piece.

BRIEF DESCRIPTION OF THE DRAWINGS.

FIG. 1 is a plan view showing a pipe cutter according to the present invention attached to a drive transmission substantially as described in my U.S. Pat. No. 3,453,673.

FIG. 2 is a front elevation corresponding to FIG. 1;

FIG. 3 is a section on line III—III of FIG. 1;

FIG. 4 is a section on line IV—IV of FIG. 3; and,

FIG. 5 is a diagrammatic front elevation showing an alternative form of pipe cutter according to the invention.

The drive transmission 10 is fully described in my U.S. Pat. No. 3,453,673 in relation to a thread cutter which can be driven by a portable electric drill, but in the present case the thread cutting die is omitted as its screw-threaded abutment cap. Briefly, the drive transmission 10 comprises a casing provided with a number of alternative drive input sockets 11, geared to rotate a tubular member 12, and a pair of self-centering vice jaws 13 are mounted on a pivot 14 carried by the casing and are operated by a two-thread screw 15 under the

action of a handle 16 to clamp the transmission 10 onto a pipe P being worked.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The rotary member 12 is formed with a pair of grooves or slots 17 to receive parallel tongues 18 (as hereinafter described) on the pipe-cutter 19 according to the present invention. The pipe cutter 19 is then revolved slowly by the member 12 to effect cutting of a pipe P.

The pipe cutter comprises a two-part frame of which part 20 is pivotally mounted on pin 21 which is carried by base part 22.

Part 20 carries a thin cutter wheel 23 freely mounted on a pin 24.

Two relatively long rollers 25, 26 of equal diameter are rotatably mounted on pins 27, 28 in part 22 of the frame, and these rollers serve to support and position pipe P in relation to the cutter wheel 23. Roller 25 is an idler roller and is formed with a smooth hardened surface. Roller 26 is knurled to receive a frictional drive from the pipe P as the device revolves around the pipe, and this roller is formed with an eccentric 29.

A shaft 30 journaled in the frame part 22 carries a one-way roller clutch device 31 mounted at the base of an arm 32. The arm 32 carries a roller 33 at its outer end and this arm is loaded by a tension spring 34 attached to stub arm 35 on the casing of the clutch device 31 so that the roller 33 follows the cam surface of eccentric 29. A snail cam 36 is pinned to shaft 30 to rotate therewith, so that reciprocation of the arm 32, by rotation of eccentric 29, rotates the cam 36 incrementally.

A bell-crank lever 37 is pivotally mounted on the pin 21 carried by the frame part 22. The end of longer arm 38 of this lever follows snail cam 36 and shorter arm 39 provides a tapped socket for shank 40 of an adjuster screw 41 which is formed with a large circular head 42. The head 42 of the screw 41 bears against twin faces 43 on frame part 20 and these faces are formed as cam surfaces to ensure abutment with points on a diameter of the head 42 and so minimize bending of the shank 40.

The cam 36 is integral with a knurled ring body 44 formed with a slightly concave cut-out 45 which lies flush with curved recess 46 in the frame part 22 when the ring body is turned so that the arm 38 lies against the minimum radius of the cam 36.

In operation, the pipe is first inserted through the tubular member 12 of transmission 10. The ring body 44 is then rotated, suitably by the operator's thumb, until the cut-out 45 is felt to lie flush with recess 46. The pipe cutter is then placed over the pipe protruding from the tubular member 12, after loosening screw 41 if necessary, and the head 42 of screw 41 is turned clockwise to pivot frame part 20 inwardly and so clamp the cutter firmly in position on the pipe with the cutter wheel 23 at the desired line of cut. The cutter 19, together with the pipe P, and the transmission 10 are then brought together, the cutter and transmission being relatively orientated so that the tongues 18 enter the slots 17 in the member 12.

A hexagonal bit in the chuck of an electric drill (not shown) is then inserted into a suitable socket 11 and the tubular member 12 is thereby rotated to revolve the cutter 19 around the pipe. It is usually preferred to revolve the cutter so that the wheel 23 trails, but the opposite direction of rotation may be employed, and it will be appreciated that the tool will be similarly fed on rotation of roller 26 in either direction or if the roller 26 is oscillated. It will also be appreciated that when, for example, a direct gear drive is employed to feed the tool, the direction of feed will be dependent on the direction of rotation of the device.

As the cutter revolves, the roller 26 rotates in the frame and eccentric 29 reciprocates arm 32 to act through the clutch device 31 and so turn the snail cam 36 in a series of small steps. Thus, arm 38 of lever 37 is deflected to cause arm 39 to act through screw 41 and so feed the frame part 20 and thus the cutter wheel 23 radially inwardly as the cutter 19 revolves.

This process continues until the pipe is completely severed, after, say, 20 revolutions.

During the cutting operation, the pipe is clamped between rollers 25, 26 and cutter wheel 23, and the point of engagement between the wheel 23 and the pipe lies approximately on the right bisector of the line joining the contact points between the pipe and the rollers 25 and 26, so that stability is maintained. Also, since the driving torque is transmitted through two points, i.e., two slots and tongues 17/18, transverse out-of-balance force on the pipe is minimized. Further, it will be noted that the tongues lie parallel with the aforementioned right bisector so that when the cutter is positioned around any one of a range of pipe diameters the tongues 18 will correctly engage the slots 17; this geometry may be varied if the diameters of rollers 25 and 26 are unequal, but the axes of the tongues should lie parallel to the locus of the centers of the range of pipe sections which the device can accommodate. It will be appreciated that, alternatively, spigots may be provided on the rotary member 12 to engage in parallel slots or grooves in the frame of the cutter.

Furthermore, the smooth hard surface of roller 25 acts to roll out any peripheral ridge produced by the cutting action of wheel 23.

In the event of it being necessary to release the cutter from a partly severed pipe, the adjuster screw 41 can be loosened to allow retraction of the cutter wheel 23.

The cutter illustrated can be employed to cut pipes having diameters within the range indicated in FIG. 2, say one-half inch to 2½ inches outside diameter, and it will be noted that the cutter parts are so shaped that the cutter 19 will revolve within the front elevational area of the drive transmission 10 throughout the whole of its range of adjustment.

In a modification, the tool feed rate may be varied in accordance with the size or nature of the work-piece, for example, by providing for adjustment of the effective length of arm 32.

The cutter illustrated above is described as being power driven around a stationary pipe P. However, the cutter may be rotated manually by means of a handle H indicated in broken lines in FIG. 3, which may be detachable. Alternatively, the cutter may be held stationary and the pipe rotated.

Furthermore, an alternative embodiment according to the present invention, may be accommodated within a pipe, for example in an oil rig, to cut outwardly.

In a further alternative, the feed drive is derived from rotation of the cutter wheel 23, as shown in FIG. 5, or from an auxiliary roller or band passing round the pipe. Also, rollers 25, 26 may be replaced by anti-friction bearing material.

FIG. 5 illustrates the aforementioned alternative construction where the feed drive is derived from rotation of cutter wheel 23. In FIG. 5 the cutter wheel 23 is carried by a sliding bracket 50 which is arranged to slide along limb 51 of the pipe cutter frame. The cutter wheel 23 is mounted on a shaft 52 which is journaled in the bracket 50 and carries a bevel gear 53. The gear 53 is in mesh with a bevel gear 54 on the end of a shaft 55 which is also journaled in the bracket 50. The shaft 55 also carries a small pinion 56 in mesh with a larger pinion 57 secured to the end of a screw 58 which has a hand-wheel 59. The frame also carries a pair of idler bearing rollers 60. In use, the device is placed round the pipe to be cut, and the cutter wheel 23 is brought into contact with the pipe by manual adjustment of the hand-wheel 59. The device is then rotated, in the appropriate direction around the pipe, and the consequent rotation of the cutter wheel 23 turns the screw 58 to feed the wheel 23 radially inwardly.

In yet a further alternative construction, more than one cutting tool may be employed, e.g., one or both of rollers 25, 26 may be replaced by cutting wheels. Particularly in this construction, which may usefully be employed in cutting a relatively inaccessible pipe using an oscillating rather than a revolving cutter, the single-lobe eccentric 29 may be replaced by a multi-lobe cam section which produces a rate of tool feed more suitable for a cutter oscillation through, say, only 60°.

The cutter has been described as incorporating a cutter wheel 23 but a saw blade or other cutting tool can be employed; also solid rods may be cut, and tubes or rods may be grooved. Furthermore, the cutter wheel 23 may be replaced by a swaging tool for forming corrugations in pipes or for peening over the ends of pipes to form flanges. Particularly in the case of swaging or grooving, the knurled ring body 44 may be calibrated to allow presetting to predetermine, for example, the depth of a groove; it will be appreciated that although the grooving depth will increase progressively around the pipe, the tool feed rate is so small in comparison with the rotary movement of the cylindrical work-piece that the variation in groove depth is usually negligible.

I claim:

1. A device for working a cylindrical work-piece, comprising a frame, work-piece bearing means carried by said frame, a tool holder mounted on said frame and carrying a tool for working said work-piece, roller means mounted on said device to receive a drive from said work-piece on relative rotation between the device and the work-piece, and feeding means driven by said roller means to effect feeding movement of said tool relative to said work-piece.

2. A device according to claim 1, in which a cam is rotated by said roller means and a one-way clutch device is oscillated by said cam to feed said tool holder incrementally towards said work-piece.

3. A device according to claim 2, in which a second cam is rotated by said one-way clutch device and a follower is displaced by said second cam to move said tool holder.

4. A device according to claim 3, in which means are provided for adjusting the position of said second cam independently of the action of said roller means.

5. A device according to claim 3, in which indicator means are provided to indicate the starting point of the movement of said second cam.

6. A device according to claim 5, in which said indicator means comprise digitally-sensible parts associated with said second cam and said frame.

7. A device according to claim 2, in which calibrations are associated with said second cam for use in predetermining the extent of feed of said tool.

8. A device according to claim 1, in which a knurled surface is formed on said roller means to promote frictional drive between the roller means and said work-piece.

9. A device according to claim 1, in which at least one roller is adapted to support and position said work-piece in relation to said tool.

10. A device as claimed in claim 9, in which a smooth and hardened surface is formed on said at least one roller to roll out any ridge formed on the work-piece as a result of the action of said tool.

11. A device according to claim 1, in which said frame comprises a first part, a second part carrying said tool holder and mounted on said first part, and means for adjusting the initial relative positions of said first and second frame parts to adapt the device for use with a range of cylinder diameters.

12. A device according to claim 11, in which said second part is pivotally mounted on said first part.

13. A device according to claim 1 constituting a pipe cutter, said tool comprising a cutting tool.

14. A device according to claim 1 including a tool in the form of a cutter wheel carried by said tool holder.

15. A device according to claim 1 and provided with a handle for manually revolving the device.

16. A device according to claim 15, in which said handle is detachable.

17. A device according to claim 1, and provided with engagement means adapted to react against a torsional couple from a drive transmission.

18. A device according to claim 17, in which said engagement means comprise at least one tongue and slot having a common axis which lies parallel to the locus of the centers of the range of circular-section work-pieces accommodated by the device.

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19. A device according to claim 18, in which said engagement means comprises two spaced-apart tongues arranged with their axes aligned with or parallel to each other.

20. A device according to claim 1, in which compensating means are provided to adjust the tool feed rate in accordance with the size or nature of the work-piece.

21. A device according to claim 1 for use in combination with a drive transmission, wherein said device comprises parts which are so shaped that the device will rotate not substantially outside the front elevational area of said drive transmission.

22. A device according to claim 1, in combination with a

drive transmission.

23. A device for working a cylindrical work-piece comprising a frame, at least one rotary tool mounted on said frame to engage said work-piece and receive a drive from said work-piece on relative rotation between the device and the work-piece, and feeding means driven by said rotary tool to effect feeding movement of said rotary tool relative to said work-piece.

24. A device according to claim 23 in which said rotary tool is a cutting wheel.

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