Jan. 24, 1967 R. F. ATKINSON 3,300,201

PIPE CUTTING DEVICE

Filed Oct. 25, 1963 4 Sheets-Sheet 1

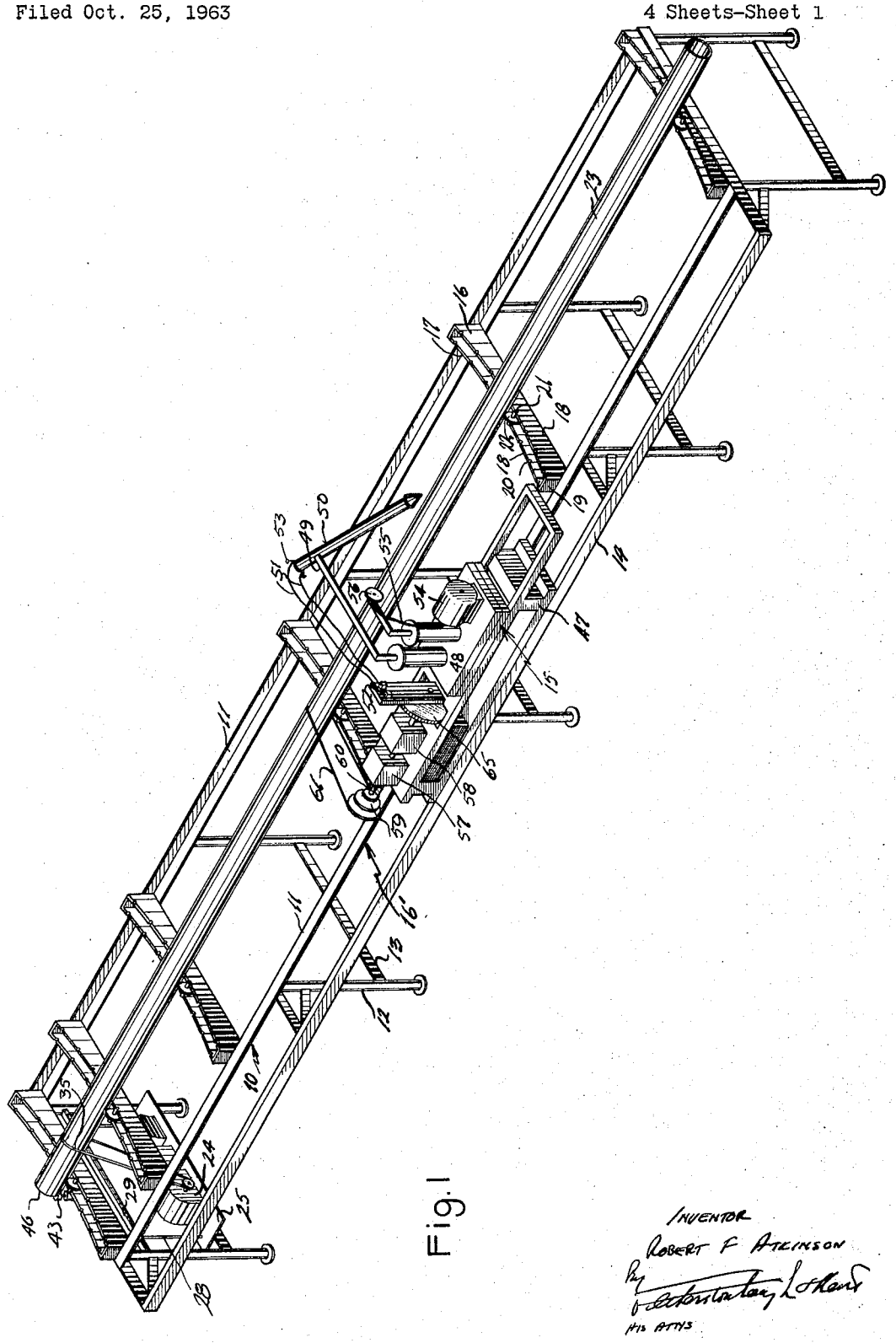


Fig. 1

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Jan. 24, 1967 R. F. ATKINSON 3,300,201

PIPE CUTTING DEVICE

Filed Oct. 25, 1963 4 Sheets-Sheet 2

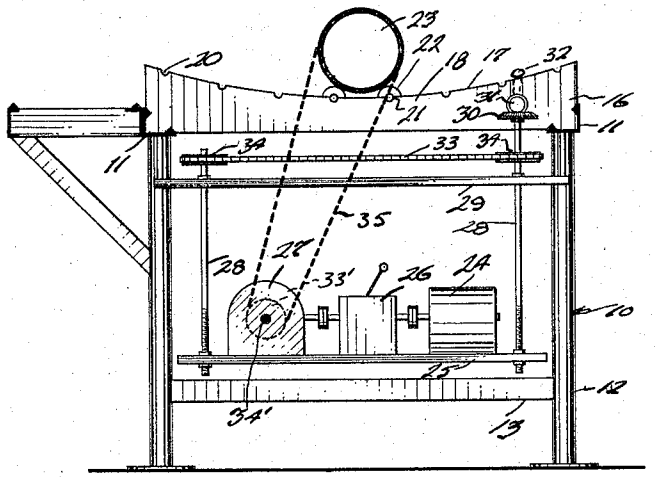


Fig. 2

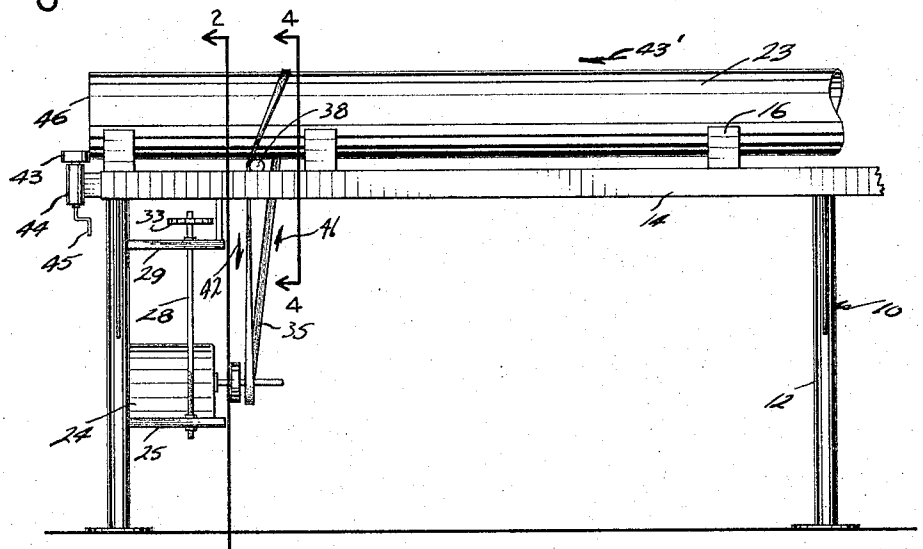


Fig. 3

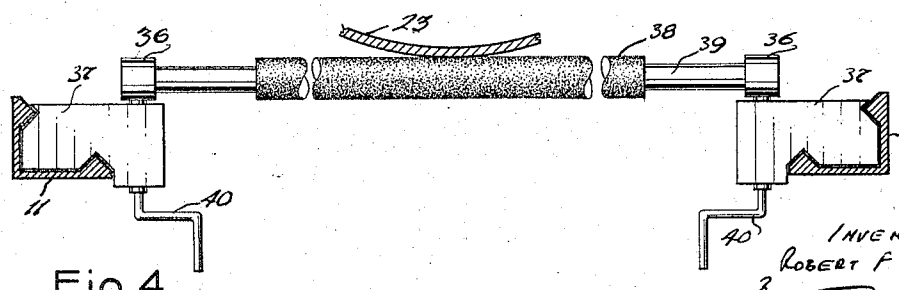


Fig. 4

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Jan. 24, 1967 R. F. ATKINSON 3,300,201

PIPE CUTTING DEVICE

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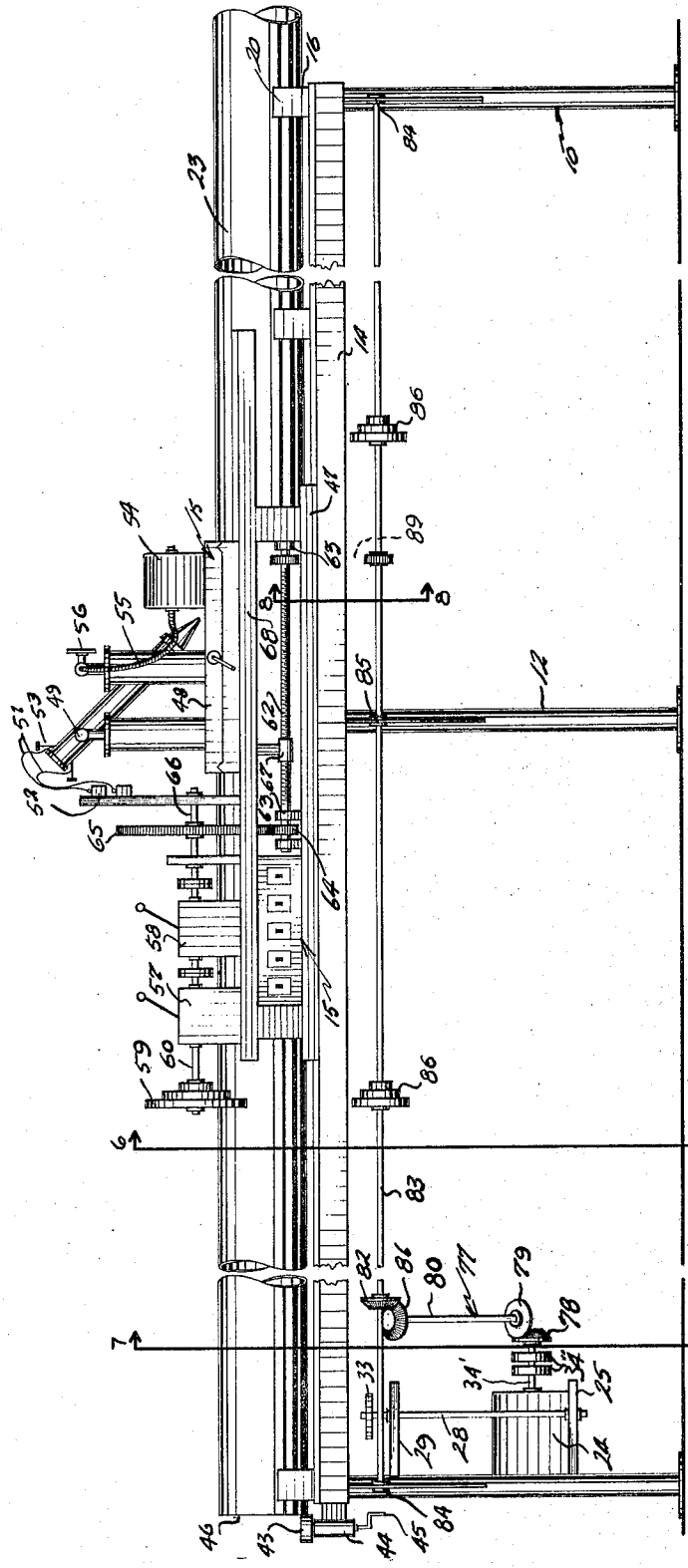


Fig. 5

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Jan. 24, 1967 R. F. ATKINSON 3,300,201

PIPE CUTTING DEVICE

Filed Oct. 25, 1963 4 Sheets-Sheet 4

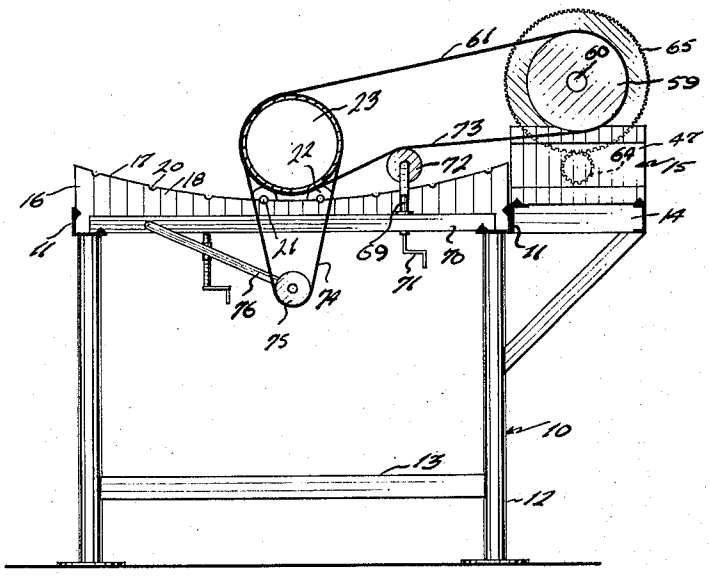


Fig. 6

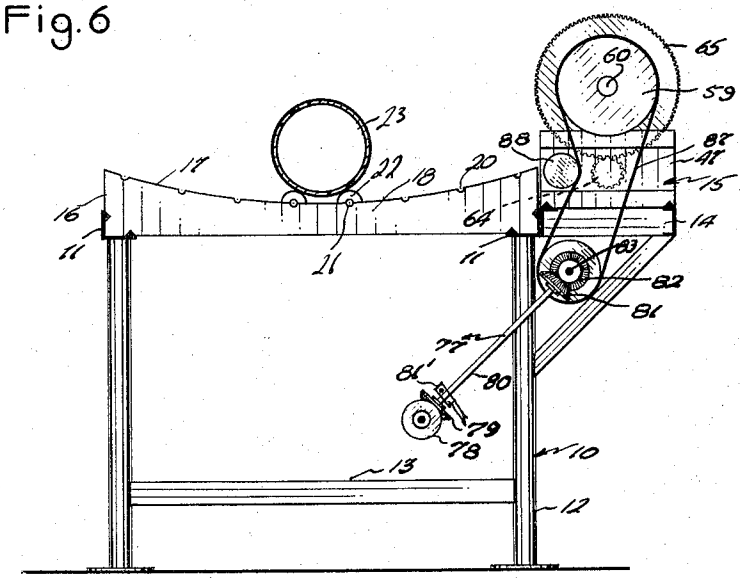


Fig. 7

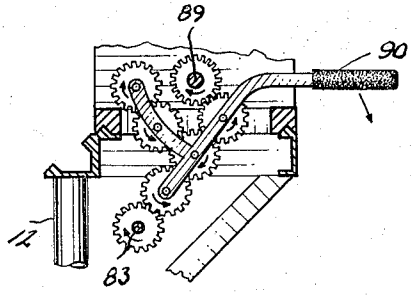


Fig. 8

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United States Patent Office 3,300,201 Patented Jan. 24, 1967

3,300,201

PIPE CUTTING DEVICE

Robert F. Atkinson, Winnipeg, Manitoba, Canada, assignor, by direct and mesne assignments, to Plumbing & Heating Ltd., Winnipeg, Manitoba, Canada, a corporation of Canada

Filed Oct. 25, 1963, Ser. No. 318,959
6 Claims. (Cl. 266—23)

My invention relates to new and useful improvements in pipe or tube cutting machines.

The principle object and essence of this invention is to provide a pipe cutting machine which can cut off pipe or tubing irrespective of the diameter, within limits, and either at right angles or at an angle less than a right angle.

Another object of the invention is to provide a device of the character herewithin described which can make cuts in a pipe or tube the correct configuration for a saddle joint.

A still another object of the invention is to provide a device of the character herewithin described which is designed for easy transportation so that it can be used in the field provided a source of electricity is available.

Still another object of the invention is to provide a device of the character herewithin described which is adaptable in use inasmuch as pipes of varying lengths and diameters can readily be cut thereby.

Still another object of the invention is to provide a device of the character herewithin described which is relatively simple in construction, economical in manufacture and otherwise well suited to the purpose for which it is designed.

With the foregoing objects in view, and such other objects and advantages as will become apparent to those skilled in the art to which this invention relates as this specification proceeds, my invention consists essentially in the arrangement and construction of parts all as hereinafter more particularly described, reference being had to the accompanying drawings in which:

FIGURE 1 is an isometric view of one embodiment of the device.

FIGURE 2 is a sectional view along the lines 2—2 of FIGURE 3.

FIGURE 3 is an enlarged fragmentary side elevation of one end of the device shown in FIGURE 1.

FIGURE 4 is an enlarged fragmentary view substantially along the line 4—4 of FIGURE 3.

FIGURE 5 is a side elevation of an alternative embodiment of the invention.

FIGURE 6 is a view along the line 6—6 of FIGURE 5 but showing a belt drive connection between the pipe and the cutting torch assembly.

FIGURE 7 is a view substantially along the line 7—7 of FIGURE 5.

FIGURE 8 is a fragmentary end elevation showing one method of applying reverse direction to the lead screw mechanism.

In the drawings like characters of reference indicate corresponding parts in the different figures.

Proceeding therefore to describe the invention in detail, FIGURES 1 to 4 inclusive show a device particularly suitable for use in the cutting of tubes or pipes at right angles and FIGURES 5 to 8 inclusive show a similar machine but including means to cut pipes at angles of less than 90 degrees for joining sections in order to make a pipe angle.

Reference character **10** generally illustrates supporting framework comprising a pair of longitudinally extending members **11**, vertical supports **12** and cross braces **13**.

One of the longitudinal members **11** together with a

longitudinally extending guide member **14** form a track along which a cutting torch assembly collectively designated **15** may be moved slidably for positioning purposes.

A plurality of saddle members **16** span the longitudinal members **11** and are slidable therealong for adjustment purposes. These saddle members include arcuately curved upper surfaces **17** and it will be noted that these saddle members are comprised of a pair of spaced and parallel side plates **18** and end plates **19**.

The upper edges of said plates **18** are notched as at **20** and these notches are adapted to receive the spindles **21** of carrying guide wheels **22** and it will be noted that there are a pair of guide wheels to each saddle assembly **16**. By positioning these spindles **21** in the desired notches **20**, the guide wheels can support varying diameters of pipe **23** which it is desired to cut.

It should also be noted at this point that as these saddles are adjustable, they can be positioned so that both the main portion of the pipe **23** can be supported and also the portion that is cut therefrom.

Reference character **24** illustrates a source of power such as an electric motor situated at one end of the supporting framework and supported by platform **25**. This platform also includes a transmission box **26** and a speed reducing gear **27**. In this connection it is desirable to have an electric motor **24** which is variable speed and reversible.

The platform **25** is supported by two vertical rods **28** extending through cross brace **29** on the supporting framework and one of the rods is provided with a bevel gear **30** at the upper end thereof engageable by a further bevel gear **31** which in turn is rotatable by means of hand crank **32**. A chain **33** extends around a pair of gears **34**, one each of which is secured to the upper ends of the rods **28**. It will therefore be appreciated that by rotating crank **32**, the platform **25** is raised or lowered within limits and maintained in a level condition.

A pulley **33'** is secured to the drive shaft **34'** of the speed reducer **27** and a belt **35** extends around this pulley and around the perimeter of the pipe **23** which is supported for rotation upon the saddles **16**.

It will therefore be appreciated that the source of power **24** rotates the pipe **23** upon the rollers **22**.

When cutting pipe by means of the torch assembly **15**, it is of course desirable that no endwise movement of the pipe occurs and in this connection reference should be made to FIGURES 3 and 4.

Vertical adjustable trunnions **36** mounted within bearing blocks **37** which in turn are supported between the longitudinals **11**. A resiliently covered roller **38** is journalled by means of spindle **39** within trunnions **36** and the trunnions are adjustable vertically by means of hand crank **40** extending below the bearing blocks **37**.

The aforementioned belt **35** passes first over the tube **23** and then over the roller **38** as clearly shown in FIGURE 3, the direction of the belt runs being indicated by arrows **41** and **42**. This causes the belt to pull the pipe endwise in the direction of arrow **43'** and by careful adjustment of the roller **38**, this pulling action is facilitated inasmuch as the roller **38** should be engaged in friction contact with the underside of the rotating pipe but not sufficient to lift the pipe clear of the rollers **22**.

A thrust roller **43** is journalled within bearing **44** at one end of the supporting framework, hand crank **45** giving limited vertical adjustment of this roller. The roller is adjusted so that it engages the end **46** of the pipe and the aforementioned belt together with the roller **38** maintains the pipe in contact with this thrust roller thus perventing longitudinal movement of the pipe.

Referring back to the vertical adjustment of the source of power base **25**, it will be appreciated that this enables one belt **35** to be used for a variety of pipe sizes.

A cutting torch assembly illustrated in FIGURE 1 is journalled for sliding movement upon the guide rails **14** and the adjacent longitudinal **11**. It consists of a box like framework **47** upon which is mounted a torch table or platform **48**. Adjustable arm **49** extending from the table holds a conventional cutting torch **50** and tubing **51** extends from the cutting torch to a solenoid assembly **52** and hence to a source of operating gas (not illustrated).

The solenoid assembly is of conventional design and enables the cutting flame to be adjusted by means of the conventional adjustors **53** on the torch and then to be extinguished and relit without changing the cutting characteristics. This solenoid assembly **52** operates valves within the lines extending to the source of supply.

Also mounted upon the platform **48** is a source of power **54** attached by means of flexible drive **55** to a grinding wheel **56** which may be used to dress the cut end of the pipe or to cut desirable bevels upon the cut end as may be required.

In the embodiment shown in FIGURE 1, lanes are provided to move the cutting torch at a predetermined rate longitudinally with respect to the rotation of the tube or pipe being cut although the lead screw assembly is not visible in this view.

FIGURE 5 shows details of this portion of the mechanism, reference character **57** indicating a reversing transmission and **58**, a variable speed transmission, all of which facilitate the choice of speeds for the travel of the carriage or platform.

A stepped pulley **59** is secured to the end of shaft **60** leading to the transmissions **57** and **58**. A belt **61** (FIG. 1) extends around this pulley and around the tube **23** being cut so that rotation of shaft **60** is dependent upon the surface speed of travel of the pipe which in turn is governed by the belt **35** extending from the source of power.

A lead screw **62** is journalled within bearings **63** mounted upon the structure **47** and a relatively small gear **64** is secured to one end of this lead screw. A relatively large gear **65** is secured to the portion **66** of shaft **60** and engages small gear **64** thus rotating the lead screw **62**.

A lead screw nut **67** is engaged around the lead screw **62** and in turn is secured to the cutter platform **48** which is slidable within the cutter platform guides **68**.

By correct selection of the pulley **59**, the table or platform **68** can move to effect a predetermined angle cut. It will be appreciated that the diameter of pipe being worked upon does not affect the relationship as the belt surface speed will be similar with the pipe surface speed which in turn is controllable through the source of power and associated reduction gearing.

When making square or right angle cuts in pipes or tubing, a relatively small variety of speeds is all that is required but when cutting angles of less than 90°, the torch will travel longitudinally as well as passing through relative motion between the pipe and torch.

As a result, when cutting an angle around 45° the pipe surface speed should be reduced considerably.

It is necessary to select the proper travel speed in inches per minutes for the various metal thicknesses being cut and it is therefore necessary to prepare a chart from which the operator of the machine can predetermine his metal thickness and torch travel, taking into account the angle from perpendicular, if any.

Inasmuch as the motion of the rotating pipe acts as the driving member of the pulley **59**, a pulley calculated for any size of pipe and for any angle will cut the same angle on all pipe sizes.

As an example, if 22½ degree cut on 10 inch diameter pipe was required, the distance to be cut back, by trigonometry is 4.142 inches (the function is a tangent of 22½ which is .4142 and the cut back depth is 10 inches). If we assume a lead screw of 10 threads per inch, the lead

screw **62** would have to turn 41.42 revolutions. If the ratio of the large gear **65** and the small gear **64** is 17.1, the large gear **65** would have to turn

$$\frac{41.42}{17}=2.436$$

revolutions.

In cutting a mitre on a pipe, a line scribed through the axis of the pipe passing through the perimeter at a point where the cut is begun would form a line symmetry. In other words, one half would be the same at the other half.

It therefore follows that the operation of making a mitre would be to form a complete operation while the pipe turns half way around (through 180°) and then to reverse the motion to perform a similar operation starting at the opposite side.

With the aforementioned 10 inch diameter pipe, length of pipe surface in 180° equals

$$\frac{10\times 3.1416}{2}$$

equals 15.708 inches.

Therefore the large gear must turn 2.436 revolutions in 15.708 inches of belt travel.

Therefore the circumference of pulley **59** will be

$$\frac{15.708}{2.436}$$

equals 6.448 inches.

Therefore the diameter will be 2.052 inches.

If the same calculations are worked for example, for a 3 inch pipe and a 22½ degree angle, it will be found that the pulley diameter **59** will also be 2.052 inches.

It is of course desirable to ensure that no slippage occurs between belt **61**, pulley **59** and pipe **23** and reference to FIGURE 6 will show one method of belt tightening to reduce this slippage to the minimum.

A bearing support shaft **69** is screw threadably attached to a cross member **70** spanning the supporting framework and is rotatable by means of hand crank **71**. A belt engaging pulley **72** is secured to the opposite side of this bearing shaft **69** and engages one run **73** of the belt **61** thus applying tension thereto.

In order to maintain the tube **23** upon the wheels **22**, a further belt **74** may extend around the pipe **23** and around a belt pulley **75** carried in an adjustable bracket **76** so that downward pressure can be exerted upon the pipe **23**.

FIGURES 5 and 7 show the preferred embodiment which deals principally with the rotation of the feed screw by means of a direct gear drive.

The pipe **23** is rotated by means of the belt **35** as hereinbefore described although this portion is not illustrated in FIGURE 5. The drive pulley **34''** is shown however and belt **35** extends around the pulley and around the pipe **23**.

From the drive shaft **34**, a gear train assembly **77** is provided and consists of bevel gear **78** on shaft **34** engaging bevel gear **79** secured to one end of shaft **80** and being supported within bearings **81'**. This shaft inclines upwardly and is provided with a further bevel gear **81** upon the other end thereof which in turn engages a bevel gear **82** secured to a line shaft **83** journalled between bearings **84** and **85** on the supporting structure and below the cutting torch assembly collectively designated **15**.

Two sets of pulleys **86** are provided one upon each side of the central bearing **85** upon the line shaft **83** and these pulleys are adjustable along the line shaft as desired.

A belt **87** (FIG. 7) extends around one of these pulleys and around pulley **59** secured to the shaft **60** as hereinbefore described thus providing more positive drive between the source of power and the lead screw **62**.

In this connection, belt tightening pulley **88** is provided to maintain the correct tension of belt **87**.

If it is desirable to eliminate belt **87**, then a gear train **89** may be incorporated between the line shaft **83** and the lead screw **62**, such a gear train being illustrated in

FIGURE 8 which incorporates a conventional reversing mechanism operable by handle **90**. However, if this type of gear train is used it will be appreciated that extremely accurate control of the speed of rotation of the source of power is required.

Under these circumstances the diameter of pulley **34''** assumes considerable importance. As mentioned previously, the size of the pipe **23** being cut does not affect the size of pulley required for a predetermined angle cut. Therefore a calculation is required in order to select the correct pulley which is to be used on shaft **34'** and this pulley will have to be turned accurately as to the diameter thereof.

With this arrangement, the pipe surface speed is directly proportioned to the feed screw speed and the very slight slippage which might obtain between the belt and the pipe in any one revolution would be tolerable.

The variable speed transmission **57** shown in the drawings, is required so that in the case of a relatively small angle cut of approximately 5°, for example, the feed is relatively slow which would require a pulley **59** of relatively large diameter. By contrast, if an angle of 60° were being cut, then the feed is much faster requiring a relatively small diameter pulley.

Inasmuch as the ability of a belt to grip a pulley is proportional to the size of a pulley and inasmuch as, in this application, a very minimum amount of slippage can be tolerated, it is necessary to use pulley **59** which provides sufficient friction.

If a 6 inch diameter pulley (for example) is required to provide sufficient friction means must be provided for increasing the feed speed other than reducing the pulley size and the variable speed transmission **57** is desirable under these circumstances.

Since various modifications can be made in my invention as hereinabove described, and many apparently widely different embodiments of same made within the spirit and scope of the claims without departing from such spirit and scope, it is intended that all matter contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

What I claim as my invention is:

1. A pipe cutting machine comprising in combination a longitudinally extending supporting framework, means for supporting a length of pipe for rotation thereon, means to rotate said pipe, means on one end of said framework for eliminating endwise movement of said rotating pipe, and a cutting torch assembly adjustably positioned on said framework, said means to rotate said pipe comprising a source of power in said framework, and a drive belt extending from said source of power, and around said pipe, said means for eliminating endwise movement of said pipe comprising in conjunction with said drive belt, a transverse roller journalled for rotation across said supporting framework and adjacent one end thereof, said transverse roller being adjustable within limits upwardly and downwardly and adapted to contact said rotating pipe, one side of said belt passing over said transverse roller and rotating same

in a direction to urge said pipe towards one end of said supporting framework, a vertically adjustable thrust roller secured to said one end, the perimeter of said thrust roller being engageable with the adjacent end of said pipe.

2. The device according to claim **1** in which said means for supporting said length of pipe comprises a pair of longitudinally extending rails forming part of said supporting framework, a plurality of cradles spanning said rails and adjustable therealong, each of said cradles including an arcuate upper surface and pair of guide wheels journalled for rotation within said upper surface, said guide wheels being adjustable across said arcuate surface.

3. The device according to claim **1** which includes means on said framework for moving said cutting torch assembly lengthwise as said pipe rotates.

4. The device according to claim **3** in which said means comprises a longitudinally extending guide assembly secured to said framework and parallel therewith, said cutting torch assembly being slidably mounted for adjustment along said guide assembly, a pair of torch platform guides mounted on said guide assembly, a torch platform mounted for sliding movement on said platform guides, a lead screw assembly journalled for rotation on said platform guides, a lead screw nut engaging said lead screw and being secured to said torch platform, means operatively connecting said lead screw for rotation to said source of power and means for reversing the direction of rotation of said lead screw.

5. The device according to claim **4** in which said means operatively connecting said lead screw for rotation to said source of power includes a pulley on one end of said lead screw and a belt extending around said pulley and said pipe whereby rotation of said pipe causes rotation of said lead screw and hence movement of said torch platform.

6. The device according to claim **4** in which said means operatively connecting said lead screw for rotation to said source of power comprises a line shaft journalled for rotation in said supporting framework and parallel to said longitudinal guide assembly, a gear train connected between said source of power and said line shaft, at least one pulley assembly on said line shaft, a pulley on one end of said lead screw, and a belt extending around said lead screw pulley and said pulley assembly on said line shaft.

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L. J. WESTFALL, *Assistant Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,300,201 January 24, 1967

Robert F. Atkinson

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the heading to the printed specification, lines 4 and 5, for "Plumbing & Heating Ltd." read -- Associated Plumbing & Heating Ltd. --.

Signed and sealed this 14th day of November 1967.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNEI
Commissioner of Patents