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Pipe clamp, pipe clamp driver and anti-backdrive mechanism

Abstract

A power tool including a housing and a motor housed in the housing. There is a spring engine housed in the housing and a driver blade driven by the spring engine. Additionally, the power tool holds a pipe clamp configured to be driven into a workpiece by the driver blade.

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
3924692	12/1974	Saari	173/117	B25C 1/06
4801064	12/1988	Mangone, Jr.	411/908	H02G 1/00
5350267	12/1993	Mangone, Jr.	411/457	F16L 3/1207
6481612	12/2001	Mangone, Jr.	227/140	B25C 5/00
6530803	12/2002	Chen	439/465	H01R 13/5837
7152774	12/2005	Chen	227/129	B25C 1/06
2003/0089829	12/2002	Brandzel	248/68.1	F16L 3/222
2008/0179371	12/2007	Gardner	227/1	B25C 5/15

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) The present application is a Continuation of PCT/US2021/022250 filed Mar. 13, 2021, which claims priority to U.S. provisional patent application Ser. No. 62/989,246 entitled “Pipe Clamp, Pipe Clamp Driver and Anti-Backdrive Mechanism” filed Mar. 13, 2020, and U.S. provisional patent application Ser. No. 62/991,910 entitled “Pipe Clamp, Pipe Clamp Driver and Anti-Backdrive Mechanism” filed Mar. 19, 2020. The entirety of the above applications being incorporated herein by reference in their entirety.

BACKGROUND OF THE INVENTION
(1) The present disclosure relates to pipe clamps, pipe clamp drivers and anti-backdrive mechanisms and combinations thereof.
SUMMARY OF EMBODIMENTS OF THE INVENTION
(2) Aspects of the present disclosure relate to an exemplary embodiment of a power tool. The power tool including a housing; a motor housed in the housing; a spring engine housed in the housing; a driver blade driven by the spring engine; and a pipe clamp configured to be driven into a workpiece by the driver blade.
(3) The driver blade may include a first projection and a second projection spaced apart from the first projection.

(4) The pipe clamp may include a first nail and a second nail.
(5) The first projection may contact the first nail and the second projection contacts the second nail to drive the pipe clamp.
(6) The power tool may further include a battery pack to power the motor.
(7) According to another aspect of the invention, there is an exemplary embodiment of a pipe clamp driver including a housing; a motor housed in the housing and driving a drive shaft; a wheel driven by the drive shaft; a carriage driven by the wheel; a spring drive, the spring drive comprising a spring; a driver blade operatively connected to the carriage and configured to drive a pipe clamp; wherein the carriage compresses the spring; and wherein the carriage is driven by the spring to drive the driver blade, whereby the driver blade drives the pipe clamp.
(8) The driver blade may include a first projection and a second projection.
(9) The first projection may be spaced apart from the second projection.
(10) The first projection may be spaced apart from the second projection by at least twenty millimeters.
(11) The first projection may be spaced apart from the second projection by at least thirty millimeters.
(12) The pipe clamp may include a first nail and a second nail.
(13) The driver blade may drive the pipe clamp, the first projection contacts the first nail and the second projection contacts the second nail.
(14) According to another aspect of the invention, there is an exemplary embodiment of a pipe clamp including a pipe clamp body; a first nail; and a second nail spaced apart from the first nail.
(15) The second nail may be spaced apart from the first nail by at least 15 millimeters.
(16) The second nail may be spaced apart from the first nail by at least 20 millimeters.
(17) The second nail may be spaced apart from the first nail by at least 30 millimeters.
(18) The pipe clamp may further include a first arm and a second, the first arm and the second arm being rotatable relative to the pipe clamp body.
(19) The first arm may be substantially straight.
(20) The first arm may include a curved portion.
(21) The first arm may include a rib.
(22) An end of the first arm and an end of the second arm may be connected by a break-away portion.
(23) The pipe clamp body may further include a first holding portion for the first nail.
(24) The pipe clamp body may further include a second holding portion for the second nail.
(25) According to another aspect of the invention, there is an exemplary embodiment of a pipe clamp, including a pipe clamp body; a first arm rotatable with respect to the pipe clamp body; a second arm rotatable with respect to the pipe clamp body; a first holding portion in the pipe clamp body; a second holding portion in the pipe clamp body; a first nail held in the first holding portion; a second nail spaced apart from the first nail and held in the second holding portion.
(26) The first arm may be substantially straight.
(27) The second arm may be substantially straight.
(28) The first arm may have a curved portion.
(29) The second arm may have a curved portion.
(30) The second nail may be spaced apart from the first nail by at least 20 millimeters.
(31) The second nail may be spaced apart from the first nail by at least 30 millimeters.
(32) The pipe clamp may further include a break-away portion connecting ends of the first arm and the second arm.
(33) The pipe clamp may further include a rib formed on the first arm.
(34) The pipe clamp may further include a rib formed on the second arm.
(35) According to another aspect of the invention, there is an exemplary embodiment of an anti-backdrive system for a power tool, including a drive shaft; a holder; a locking member secured to

the holder in a non-rotatable manner; and a drive wheel connected to the drive shaft; wherein the locking member is held between the holder and the drive wheel and is axially movable towards and away from the drive wheel.
(36) The drive wheel may include at least one projecting pin.
(37) The drive wheel may have a first lock.
(38) The locking member may have a second lock.
(39) The first lock and the second lock may cooperate to prevent backdrive of the drive wheel.
(40) The first lock may be an indent.
(41) The second lock may be a ramp.
(42) The anti-backdrive system may further include a biasing member which biases the locking member towards the drive wheel.
(43) The biasing member may be a spring.
(44) The biasing member may be a wave spring.
(45) According to another aspect of the invention, there is an exemplary embodiment of a pipe clamp driver, including a housing; a motor housed in the housing and driving a drive shaft; a drive wheel driven by the drive shaft; a holder; a locking member secured to the holder in a non-rotatable manner; a carriage driven by the wheel; a spring drive, the spring drive comprising a spring; a driver blade operatively connected to the carriage and configured to drive a pipe clamp; wherein the carriage compresses the spring; wherein the carriage is driven by the spring to drive the driver blade, whereby the driver blade drives the pipe clamp; wherein the drive wheel has a first lock; wherein the locking member has a second lock; and wherein the first lock and second lock cooperate to prevent backdrive of the drive wheel.
(46) The locking member may be held between the holder and the drive wheel and is axially movable towards and away from the drive wheel.
(47) The drive wheel may include at least one projecting pin.
(48) The first lock may be an indent.
(49) The second lock may be a ramp.
(50) The pipe clamp driver may further include a biasing member which biases the locking member towards the drive wheel.
(51) The biasing member may be a spring.
(52) The biasing member may be a wave spring.
(53) These and other aspects of various embodiments of the present invention, as well as the methods of operation and functions of the related elements of structure and the combination of parts and economies of manufacture, will become more apparent upon consideration of the following description and the appended claims with reference to the accompanying drawings, all of which form a part of this specification, wherein like reference numerals designate corresponding parts in the various figures. In one embodiment of the invention, the structural components illustrated herein are drawn to scale. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of the invention. In addition, it should be appreciated that structural features shown or described in any one embodiment herein can be used in other embodiments as well. As used in the specification and in the claims, the singular form of “a”, “an”, and “the” include plural referents unless the context clearly dictates otherwise.
(54) All closed-ended (e.g., between A and B) and open-ended (greater than C) ranges of values disclosed herein explicitly include all ranges that fall within or nest within such ranges. For example, a disclosed range of 1-10 is understood as also disclosing, among other ranged, 2-10, 1-9, 3-9, etc.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) For a better understanding of embodiments of the present invention as well as other objects and further features thereof, reference is made to the following description which is to be used in conjunction with the accompanying drawings, where:

(2) FIG. **1** is a perspective view of a pipe clamp driver according to an exemplary embodiment of the present application;

(3) FIG. **2** is a side view of an exemplary embodiment a pipe clamp driver according to an exemplary embodiment of the present application;

(4) FIG. **3** is another perspective view of a pipe clamp driver according to an exemplary embodiment of the present application;

(5) FIG. **4** is another perspective view of a pipe clamp driver according to an exemplary embodiment of the present application;

(6) FIG. **5** is another perspective view of a pipe clamp driver according to an exemplary embodiment of the present application;

(7) FIG. **6** is a perspective view of selected components of a pipe clamp driver according to an exemplary embodiment of the present application;

(8) FIG. **7** is a cut-away side view of selected components of a pipe clamp driver according to an exemplary embodiment of the present application;

(9) FIG. **8** is a top view of selected components of a pipe clamp driver according to an exemplary embodiment of the present application;

(10) FIG. **9** is another perspective view of selected components of a pipe clamp driver according to an exemplary embodiment of the present application;

(11) FIG. **10** is a plan view of a driver blade of a pipe clamp driver according to an exemplary embodiment of the present application;

(12) FIG. **11** is a perspective view of selected components of a pipe clamp driver according to an exemplary embodiment of the present application;

(13) FIG. **12** is an explanatory view of a drive mechanism of a pipe clamp driver according to an exemplary embodiment of the present application;

(14) FIG. **13** is an explanatory view of a drive mechanism of a pipe clamp driver according to an exemplary embodiment of the present application;

(15) FIG. **14** is an explanatory view of a drive mechanism of a pipe clamp driver according to an exemplary embodiment of the present application;

(16) FIG. **15** is a perspective view of a pipe clamp according to an exemplary embodiment of the present application;

(17) FIG. **16** is another perspective view of a pipe clamp according to an exemplary embodiment of the present application;

(18) FIG. **17** is a perspective view of a pipe clamp according to another exemplary embodiment of the present application;

(19) FIG. **18** is a perspective view of a pipe clamp according to another exemplary embodiment of the present application;

(20) FIG. **19** is a perspective view of a collated stick of pipe clamps according to an exemplary embodiment of the present application;

(21) FIG. **20** is a side view of a pipe clamp according to an exemplary embodiment of the present application;

(22) FIG. **21** is a side view of a pipe clamp according to an exemplary embodiment of the present application;

(23) FIG. **22** is a side view of a pipe clamp according to an exemplary embodiment of the present application;

(24) FIG. **23** is a side view of a pipe clamp according to an exemplary embodiment of the present

application;
(25) FIG. **24** is a side view of a corrugated pipe;
(26) FIG. **25** is a perspective view of a pipe clamp according to an exemplary embodiment of the present application;
(27) FIG. **26** is a side view of a pipe clamp according to an exemplary embodiment of the present application;
(28) FIG. **27** is a side view of a pipe clamp according to an exemplary embodiment of the present application;
(29) FIG. **28** is a side view of a pipe clamp according to an exemplary embodiment of the present application;
(30) FIG. **29** is a perspective view of an anti-backdrive mechanism according to an exemplary embodiment of the present application;
(31) FIG. **30** is a perspective view of an anti-backdrive mechanism and frame according to an exemplary embodiment of the present application;
(32) FIG. **31** is a bottom perspective view of an anti-backdrive mechanism and frame according to an exemplary embodiment of the present application;
(33) FIG. **32** is a bottom perspective view of selected components of an anti-backdrive mechanism according to an exemplary embodiment of the present application;
(34) FIG. **33** is a bottom perspective view of selected components of an anti-backdrive mechanism according to an exemplary embodiment of the present application;
(35) FIG. **34** is a bottom perspective view of selected components of an anti-backdrive mechanism according to an exemplary embodiment of the present application;
(36) FIG. **35** is a bottom perspective view of selected components of an anti-backdrive mechanism according to an exemplary embodiment of the present application;
(37) FIG. **36** is a bottom perspective view of selected components of an anti-backdrive mechanism according to an exemplary embodiment of the present application;
(38) FIG. **37** is a top perspective view of selected components of an anti-backdrive mechanism according to an exemplary embodiment of the present application;
(39) FIG. **38** is a top perspective view of selected components of an anti-backdrive mechanism according to an exemplary embodiment of the present application;
(40) FIG. **39** is a top perspective view of selected components of an anti-backdrive mechanism according to an exemplary embodiment of the present application;
(41) FIG. **40** is a bottom perspective view of selected components of an anti-backdrive mechanism according to an exemplary embodiment of the present application;
(42) FIG. **41** is a top perspective view of selected components of an anti-backdrive mechanism according to an exemplary embodiment of the present application;
(43) FIG. **42** is a rear perspective view of a pair of pipe clamps with a collating feature according to an exemplary embodiment of the present application;
(44) FIG. **43** is a rear perspective view of a pipe clamp with a collating feature according to an exemplary embodiment of the present application;
(45) FIG. **44** is a rear plan view of a pipe clamp with a collating feature according to an exemplary embodiment of the present application;
(46) FIG. **45** is a rear perspective view of pipe clamps with a collating feature according to an exemplary embodiment of the present application;
(47) FIG. **46** is a top view of an exemplary embodiment of a driver blade with wide driving projections and a foam over plastic pipe; and
(48) FIG. **47** is a top perspective view of an exemplary embodiment of a flat front driver blade and a pipe clamp including a staple.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS OF THE INVENTION

(49) FIGS. **1** and **2** illustrate an exemplary embodiment of a pipe clamp driver **10**. As described

below, the pipe clamp driver **10** of the exemplary embodiment is a powered tool configured to drive pipe clamps into work surfaces. FIG. **1** is a perspective view of the pipe clamp driver **10** with a portion of the housing **11** removed. FIG. **2** is a side view of the exemplary embodiment of the pipe clamp driver **10** with one side of the housing **11** removed to show internal features.

(50) As shown in FIGS. **1** and **2**, the pipe clamp driver **10** includes a handle **12**. There is a user-actuatable trigger **13** on the handle. A removable and rechargeable power tool battery pack **50** powers the pipe clamp driver tool **10**. The battery pack **50** may be of the type shown in, for example, U.S. Pat. Nos. 7,598,705; 7,661,486; or U.S. Patent Application Publication No. 2018/0331335. U.S. Pat. Nos. 7,598,705; 7,661,486; and U.S. Patent Application Publication No. 2018/0331335 are hereby incorporated by reference.

(51) As further shown in FIGS. **1** and **2**, the pipe clamp driver includes a motor **60**. The motor **60** of the exemplary embodiment is a brushless motor, but a brushed motor or other motors may be used. The motor **60** drives a transmission **61**. The transmission **61** in turn is connected to a drive shaft **62**. There is a home position magnet **63** on the drive shaft **62** and a home position sensor **64** adjacent to the home position magnet. The drive shaft **62** is supported by a ball bearing **65**. There may be various other ball or other bearings in the pipe clamp driver **10**.

(52) A spring engine **100** is positioned at an end of the drive shaft **62** opposite the transmission **61**. The spring engine **100** is secured in the housing **11** with a support structure **78**. The spring engine **100** includes a pair of drive springs **101**, **102** and drives a driver blade **110** (See FIG. **6**). At the front of the tool there is a nose **201** and a contact trip **202**. The contact trip **202** is depressed to allow operation of the driver **10** and avoid driving when the driver nose **201** is not adjacent to a pipe. A magazine **200** holds a plurality of pipe clamps, such as the pipe clamp **300** shown in FIGS. **15** and **16**. The magazine **200** feeds the pipe clamps to the nose **201** for driving. A platform **204** is biased upwardly towards the nose **201** by a biasing member, as is shown in FIG. **3** to feed the pipe clamps to the correct position within the nose **201**. The pipe clamps may be collated into a collated set of pipe clamps **305**, as is shown in FIG. **19**. When operated, the spring engine **100** drives the driver blade **110** so that it drives a pipe clamp **300** at the nose **201** into a workpiece.

(53) FIGS. **3-5** illustrate various front perspective views of the pipe clamp driver **10**. FIG. **3** illustrates the pipe clamp driver **10** without any pipe clamps loaded into the magazine **200**. FIG. **4** illustrates the driver blade **110** in a firing or full compression position. In this position, the driver blade **110** is ready to fire to drive the pipe clamp **300** into a workpiece. FIG. **5** illustrates the driver blade **110** in a pickup or full extension position. In the pickup/full extension position, the pipe clamp **300** has been driven by the driver blade **110** and will have been set into a workpiece when positioned against a workpiece before firing.

(54) FIGS. **6-11** illustrate the mechanical spring engine **100** in more detail. FIG. **6** is a side perspective view of the mechanical spring engine **100** and FIG. **7** is a side cut-away view of the engine **100**. As shown in FIGS. **6** and **7**, the drive shaft **62** feeds into the spring engine **100**. In particular, an end of the drive shaft **62** is connected to a drive wheel **66**. The drive wheel **62** includes a pair of drive pins **67** and **68**.

(55) The spring engine **100** includes a pair of drive springs, outer drive spring **101** and inner drive spring **102**. Outer drive spring **101** has a greater diameter than inner drive spring **102** and inner drive spring **102** is radially inside of outer drive spring **101**. The springs are held on a front end by a carriage **70** and at a rear end by a rear support surface **75**. As shown in FIGS. **6** and **7**, the driver blade **110** is held by the carriage **70**. Additionally, as shown in FIG. **6**, the carriage **70** is connected to the drive wheel **66**, and particularly is selectively connected to the drive wheel pins **67** and **68**.

(56) As shown, the driver blade **110** is connected to the carriage **70** at a carriage connector portion **73**. This causes the driver blade **110** to move with the carriage, both forward toward the nose **200** of the driver **10** and rearward toward the rear support surface **75**.

(57) The driver blade **110** has a first projection **111** and a second projection **112**. As shown in FIG. **10**, the first projection and the second projection are spaced apart from one another at a distance S.

The distance S may be at least 15 millimeters, at least 20 millimeters, at least 25 millimeters; at least 30 millimeters; at least 40 millimeters; or at least 50 millimeters. The distance S is measured in a direction transverse to a direction of travel of the carriage **70** and the driver blade **110**. The projections **111** and **112** contact nails **301** in the pipe clamp **300**. Having a forked driver blade **110** including two projections **111**, **112**, allows the driver blade **110** to contact and drive at two different points at the same time. That is, the projection **111** can contact one nail **301** on a first side of a pipe clamp **300** while the projection **112** contacts another nail **301** on an opposite side of the pipe clamp **300**. This allows a relatively wide fastener, here a pipe clamp **300**, to be driven by the driver **10**.

(58) In operation, the motor **60** drives the transmission **61**, which rotates the drive wheel **66**. The drive wheel pins **67** and **68** interact with the carriage **70** to move the carriage **70** backwards towards the rear support surface **75** and compress the springs **101** and **102**. The carriage **70** is then decoupled and driven forward by the springs **101** and **102**. The driver blade **110** is driven by the carriage **70**. The driver blade **110** contacts the pipe clamp **300** to drive the pipe clamp **300** held at the nose **201**.

(59) FIG. **10** illustrates an exemplary embodiment of the driver blade **110**, including dimensions of the exemplary embodiment. As shown, the driver blade **110** includes a body portion **103** and a first projection **101** and a second projection **102** projecting from the body portion **103**. The driver blade **110** also includes a connection portion **105** with a connector projection **106**. The connector portion **105** connects with the carriage **70** at the carriage connector portion **73**. An extension portion **104** connects the connector portion **105** with the body portion **103**.

(60) FIG. **10** provides dimensions for the exemplary embodiment in millimeters. In particular, FIG. **10** illustrates a dimension A of 4.5 millimeters (mm); a dimension B of 2 mm; a dimension C of 41.8 mm; a dimension D of 22.45 mm; a dimension E of 36.5 mm; a dimension L of 85.25 mm; a dimension R of 13.6 mm; and a dimension S of 31.5 mm. Although those are the specific dimensions of the exemplary embodiment shown in FIG. **10**, the present application contemplates that the dimensions may vary in different ranges or limits. For example, each of the various shown dimensions (including, at least, A, B, C, D, E, R, L and S) may be 10 percent more or less than those shown. The dimensions may be 20 percent more or less than those shown. The dimensions may be 30 percent more or less than those shown; 50 percent more or less than those shown; 100 percent more or less than those shown; 150 percent more or less than those shown; or 200 percent more or less than those shown.

(61) In some embodiments, the depth D, which is equivalent to the length of the projections **101** and **102**, may be less than 50 millimeters; less than 40 millimeters; less than 30 millimeters or less than 20 millimeters. The depth D may also be more than 5 millimeters; more than 10 millimeters; more than 15 millimeters or more than 20 millimeters.

(62) FIGS. **12-14** further illustrate operation of the drive of the pipe clamp driver **10**. FIG. **12-14** illustrate interaction between the drive wheel **66**, carriage **70** and spring engine **100**. The springs **101** and **102** are not shown in the illustration for the purposes of explanation. FIG. **12** shows the driver **10** in a home position. FIG. **13** illustrates the driver **10** in a firing position and FIG. **14** illustrates the driver **10** in a pick-up position.

(63) As discussed above, the motor **60** drives the transmission **61**. The transmission turns a drive shaft **62**. The drive wheel **66** interacts with tabs **71** and **72** on the carriage, which pulls the carriage **70** back as the drive wheel **66** rotates. This compresses the drive springs **101** and **102**, which are disposed between the carriage **70** and the rear support surface **75**.

(64) The clamp driver **10** starts at the home position shown in FIG. **12** with the springs **101** and **102** partially compressed. In the exemplary embodiment shown in FIG. **12**, the second pin **68** contacts the second tab **72**. This is shown schematically below the perspective illustration. As will be appreciated, the second pin **68** pulls the carriage **70** backwards towards the rear support surface **75** to compress the springs **101** and **102**. As the drive wheel **66** rotates clockwise (CW), the pin **68** rotates out of engagement with the second tab **72**. As soon as the pin **68** is no longer in contact with

the tab **72**, the carriage **70** is in the firing position shown in FIG. **13**. At this time, the carriage **70** is no longer being held back by the drive wheel **66** and the compressed springs **101** and **102** accelerate the carriage **70** forwards towards the front support **76**.

(65) The driver blade **110** is a forked blade **110**. The forked driver blade **110** strikes the two nails **301** inside the pipe clamp **300**. In particular, a first projection **111** of the driver blade **110** contacts one nail **301** and a second projection **112** contacts a second nail **301**. After the drive is completed, the drive wheel **66** continues rotating until it is in the pick-up position, shown in FIG. **13**, at which time the drive wheel **66** begins pulling the carriage **70** backwards towards the rear support **75**, thereby compressing the drive springs **101** and **102** for another actuation. There are two pins **67** and **68** and two tabs **71** and **72** and a handoff between pins during the sequence. During the handoff, pin **67** applies a force to tab **71** until it rolls off the edge of tab **71**. Then the carriage **70** moves forward for a brief instant until tab **72** begins to apply force to tab **72**. This is what is referred to as a handoff between the pins **67** and **68**. As described further below, there may be more or fewer than two pins and two tabs.

(66) Once the home position magnet **63** is detected by the home position sensor **64**, which in this case is a hall sensor, the motor **60** begins its braking sequence to stop the drive wheel rotation at the home position (FIG. **12**). An anti-backdrive ratchet, described below, locks the position of the drive wheel **66** in comparison to the support structure **78**, preventing the drive springs **101** and **102** from decompressing after the motor **60** is de-energized.

(67) Exemplary embodiments of pipe clamps which can be used with the pipe clamp driver **10** are shown in FIGS. **15-18**. FIGS. **15** and **16**, illustrate a first embodiment. FIG. **17** illustrates a second exemplary embodiment and FIG. **18** illustrates a third exemplary embodiment.

(68) The pipe clamps **300**, **320**, **340** are designed to be driven by the pipe clamp driver **10** over a pipe and into a workpiece, such as a wood surface. FIGS. **15** and **16** illustrate a first exemplary embodiment of a pipe clamp **300**. The pipe clamp **300** includes a body portion **306**. The body portion **306** includes a pair of receiving portions **307**. The receiving portion **307** are generally through holes which can receive a fastener, such as nails **301**. In the exemplary embodiment, the pipe clamp **300** includes a pair of nails **301**, one in each receiving portion **307**. As shown, the nails **301** are at opposite ends of the pipe clamp **300**.

(69) The pipe clamp **300** also has a pair of clamp fingers **302** which extend from the clamp body **306** at connection point **308**. In the exemplary embodiment, the clamp fingers **302** have a straight portion **309** and a curved portion **311**. The curved portions **311** can be made to engage a pipe and the straight portions **309** can be used to help separate the pipe being held from a workpiece to which the pipe clamp **300** is being fastened. The clamp fingers **302** are rotatable so that they can hold and secure pipes with different diameters. As discussed above, in operation of the pipe clamp driver **10**, the nails **301** are driven by the driver blade **110** with projections **111** and **112**. This drives the nails **301** into a work surface, such as a wood surface. A pipe (not shown) is then clamped between the fingers **302** and the work surface.

(70) FIG. **17** is a second exemplary embodiment of a pipe clamp **320**. As shown in FIG. **17**, the pipe clamp **320** similarly has a pipe clamp body **326** and a pair of receiving portions **327** for receiving a fastener. Additionally, the pipe clamp **320** includes a pair of nails **301** for use with the blade clamp driver **10**. In this instance, the pipe clamp **320** does not include flexible finders. Instead, the pipe is simply held in the pipe clamp **320** and may contact the pipe clamp surface **321**.

(71) FIG. **18** is another exemplary embodiment of a pipe clamp. The pipe clamp **340** includes a pipe clamp body **346**, receiving portions **347** and a pair of nails **301**, like the other embodiments, and can be used with the pipe clamp driver **10**. The pipe clamp **340** includes fingers **342** that are generally straight. Additionally, a break-away portion **343** connects adjacent ends of the fingers **342**.

(72) FIGS. **20** and **21** illustrate a pipe clamp **350** after it has been driven into a work-surface **500** to secure a pipe. The pipe clamp **350** is the same as pipe clamp **300**, except that it additionally has a

break-away portion **303**. FIG. **20** illustrates the pipe clamp **350** securing a pipe **510** of a first diameter to a surface **500**. As shown, the pipe **510** is separated from the work surface as shown by the arrow X. FIG. **21** illustrates the pipe clamp **350** securing a pipe **511** with a larger diameter than the pipe **510**. As shown in FIG. **21**, the arms **302** rotate away from one another and the break-away portion **303** is broken during driving when the larger pipe **511** is secured. Again, the pipe **511** is separated from the surface **500** as shown by the arrow X. The distance of separation can vary.

(73) FIGS. **22** and **23** illustrate the pipe clamp **340** shown previously in FIG. **18** in usage. The pipe clamp **340** includes straight arms **342** and a break-away section **343**. In particular, the arms **342** have a first surface **344** and a second surface **345**. The first surface **344** is substantially parallel to the second surface **345**. Additionally, the first surface **344** and the second surface **345** are substantially flat. The break-away section **343** is a section of lesser strength which may be created by using less material or a different material, for example. FIG. **22** illustrates the pipe clamp **340** holding the relatively small pipe **510** to a workpiece **500**. As shown in FIG. **22**, the shape of the arms **342** cause the pipe **510** to contact the workpiece **500** directly. FIG. **23** illustrates the pipe clamp **340** holding the larger pipe **511**. As shown in FIG. **22**, when the smaller pipe **510** is secured by the pipe clamp **340**, the break-away portion **343** remains intact. As shown in FIG. **23**, when the larger pipe **511** is secured by the pipe clamp **340**, the break-away portion **343** breaks to allow further rotation of the arms **342**.

(74) FIGS. **25-28** illustrate another exemplary embodiment of a pipe clamp **370**. The pipe clamp **370** is configured to hold a corrugated pipe, such as the corrugated pipe **550** shown in FIG. **24**. Corrugated pipes, such as the pipe **550**, include regular grooves. The pipe clamp **370** includes arms **372** that include ribs **374**. The ribs fit into one of the grooves **551** of the corrugated pipe **550** and stop the corrugated pipe from moving axially. FIGS. **23-25** illustrate the pipe clamp **370** holding corrugated pipes **550**, **550′** and **550″** of various sizes. Although not shown in the exemplary embodiment, the pipe clamp **370** may also include a break-away portion connecting ends of the arms **372**. In the exemplary embodiment, the pipes **550**, **550′** and **550″** are held in a position where they would contact a workpiece. However, in some embodiments the pipes **550**, **550′** and **550″** could be held at a distance from the workpiece into which the clamp **370** is driven.

(75) All of the above-described pipe clamps are configured to be driven by the pipe clamp driver **10** described above. For example, each of the pipe clamps includes a pair of spaced apart nails **301** as shown in, for example, FIGS. **15-18**. These nails **301** correspond to the projections **111** and **112** of the driver blade **110**. Additionally, each of the above-described pipe clamps may be collated, as shown in the exemplary embodiment of FIG. **19**, and provided to the magazine **200** where they are fed for driving. It is also contemplated that the various features of the pipe clamps may be combined or replaced with one another in the various embodiments. For example, a rib feature such as the ribs **374** may be added to arms of any of the other embodiments, in which case the ribs may conform to the shape of the particular arms. Additionally, a break-away portion between ends of arms may be added or removed from any of the embodiments. Additionally, the arms of the pipe clamps may be substituted among the various embodiments. For example, the arms of the various pipe clamps may be substantially straight, they may be substantially curved or they may have both straight and curved portions.

(76) FIGS. **29-41** illustrate an exemplary embodiment of an anti-backdrive system. The anti-backdrive system is a ratchet system configured to prevent the drive wheel **66** from rotating backwards when the motor **60** is de-energized. The exemplary embodiment shown in the present application accomplishes this in a compact configuration.

(77) FIG. **29** is a perspective view of the drive shaft **62**, holder **250**, locking piece **260** and drive wheel **66**. In addition to the first and second drive pins **66** and **67**, the drive wheel **66** shown in FIGS. **29-41** includes a third drive pin **69**. Although shown with a three drive pin design, the third pin may be removed so that it operates with only two pins. Additionally, the drive wheel **66** may have a single pin design.

(78) If a third drive pin **69** is used, a third tab can be added to the carriage **70** to work with the third pin **69** and the spring drive engine will work in a similar manner but with three pins. Similarly, only a single pin can be used in which case there would be only a single tab on the carriage **70**.
(79) The locking piece **260** is secured rotationally by the holder **250**. The locking piece **260** pushes down a wave spring **281** (FIG. **35**) to allow the drive wheel **66** to turn in the correct direction and gets pushed up on by the wave spring **281** to lock the drive wheel **66** and prevent backdrive.
(80) The holder **250** is secured to the support structure **78** of the driver **10** by a plurality of screws, such as four screws. The wave spring **281** sits inside the top part of the holder **250**. The locking piece **260** has a pair of legs **261** that lock onto the holder **250**. This locking system allows the locking piece **260** to only move along the axis of the drive shaft **62**.
(81) In other embodiments the wave spring **281** or other biasing member may be secured in a different manner. For example, if the holder **250** is outside of the frame or support structure **78**, as in FIG. **7**, then the wave spring **281** may be secured by the support structure **78** or other component. Similarly, the locking piece **260** may be restrained from rotational movement by other parts or methods other than meshing with the holder **250**. For example, again referring to FIG. **7** in which the holder **250** is outside of the frame **78**, the legs **261** of the locking piece **260** may be held directly by the frame **78**. For example, there may be cut-outs for the legs **261** and the cut-outs may restrain rotational motion of the legs **261** and therefore the locking piece **260**. In other embodiments, the locking piece **260** may have parts other than legs **261** for restraining rotational movement.
(82) The drive wheel **66** is connected to the drive shaft **62** which is held in place by a bearing **55** which is contained by the bearing holder **250** that is attached to the support structure **78**. As the drive shaft **62** rotates it turns the drive wheel **66**. Indents **81** (FIGS. **32** and **33**) on the drive wheel **66** travel over ramps **85** (FIG. **38**) (locking keys) on the locking piece **260**. This upward force caused by the wave spring **281** causes the locking piece **260** to travel up as the indents **81** align with the ramps **85** and down as they rotate apart. When the drive wheel **66** tries to rotate backwards, it is stopped when the side faces of the ramps contact the side faces of the indents **81**.
(83) In some embodiments, the holder **250** may be used to hold a bearing. For example, as shown in FIG. **7**, a bearing **55** is held inside the holder **250**.
(84) Additionally, the holder may be located outside or inside the frame **78**. For example, as shown in FIG. **7**, the holder **250** is below the frame **78**, whereas in FIG. **30** the holder **250** is located inside the frame **78**.
(85) FIG. **29** is a perspective view of the anti-backdrive mechanism **700**. As shown, the drive shaft **62** feeds into the mechanism **700**.
(86) FIG. **30** is a perspective view of a the anti-backdrive mechanism with a portion of the support structure **78**.
(87) FIG. **31** is a bottom perspective view. As shown in FIG. **31**, there are four screw holes **91** in the support structure **78** through which screws can be driven to secure the holder **250**.
(88) FIGS. **32**-**41** illustrate various assemblies with one or multiple components. FIG. **32** illustrates a perspective view of the drive wheel **66** and FIG. **33** illustrates a similar view with the addition of the drive shaft **62** connected to the drive wheel. The drive shaft **62** can be screwed into the drive wheel **66** or they may be connected by other means such as welding, frictional fit or other means. In any event, the drive wheel **66** is driven by the drive shaft **62** when the drive shaft **62** rotates.
(89) As shown in FIGS. **32** and **33**, a bottom side of the drive wheel **66** includes three indents **81**. The indents **81** provide a gradually indented slope. In some embodiments, there may be more or fewer than three indents **81**. Additionally, it can be seen that the drive wheel **66** has a ratcheted outer surface with a number of uniformly spaced teeth **166**.
(90) FIG. **34** is a similar view to FIGS. **32** and **33**, but also includes the locking piece **260** with legs **261**. FIG. **35** additionally includes the wave spring **281**. Although the exemplary embodiment utilizes a wave spring **281**, other biasing members may be utilized to bias the locking member **260**

away from the holder **250** and towards the drive wheel **66**. The biasing member, for example, could be a rubber member or a different type of spring.
(91) FIG. **36** is likewise a bottom perspective view similar to **32-35**. In comparison to FIG. **35**, the illustration of FIG. **36** further adds the holder **250**, which includes four projections or nubs **251**. The legs **261** of the locking member **260** sit between the nubs **251** to prevent relative rotation of the locking member **260** with respect to the holder **250**. Additionally, each of the nubs has a screw hole **252**. The screw holes **252** are aligned with the holes **91** in support structure **78** shown in FIG. **31** so that the holder **250** can be secured to the support structure **78**. The holder **250** can also be secured by other means, such as, for example, by other types fasteners. As will be appreciated, the locking member **260** is held between the holder **250** and the drive wheel **66**. The locking member **260** can translate axially in a vertical direction against the force of the wave spring **281**.
(92) FIGS. **37** through **39** are top perspective views of portions of the assembly. FIG. **37** illustrates the assembly with the drive shaft **62**, holder **250**, locking member **260** and drive wheel **66**. The locations for the pins are shown, but not the pins themselves. FIG. **38** is similar to FIG. **37**, but does not include the drive wheel **66**. As shown in FIGS. **37** and **38**, the drive shaft **62** has a top end **162** that is threaded and onto which the drive wheel **66** is secured by screwing the drive wheel **66** onto the top end **162** of the shaft. The drive wheel **66** may be secured to the top end **162** of the shaft **62** by other means. For example, there may be a frictional fit, a lock and key, a combination of a lock and key and frictional fit, meshing splines, fasteners, adhesives, welding or a combination of these means of connection.
(93) FIG. **38** illustrates the previously discussed ramps **85**. The ramps **85** may also be referred to as locks, locking projections or locking members. The ramps **85** project upwardly from a top surface of the locking member **260**. The ramps **85** oppose the previously discussed indents **81** and cooperate with the indents **81** to prevent backdrive, as previously discussed. The shape and size of the ramps **85** and indents **81** are complementary with the ramps **85** fitting into the indents **81**. Other locking structures may be used such as rectangular tabs rather than ramps and corresponding indents.
(94) FIG. **39** is a similar view as FIG. **38**, but does not include the locking member **260**. Accordingly, the wave spring **281** is visible.
(95) FIG. **40** illustrates a bottom perspective view of the drive wheel **66**. The arrow R (counter-clockwise) illustrates the direction in which the drive wheel **66** can rotate. The arrow NR illustrates the direction (clockwise) in which the drive wheel **66** cannot rotate.
(96) FIG. **41** illustrates a top perspective view of the locking member **260** along with the vertical translating direction T in which the locking member **260** can translate.
(97) The anti-backdrive system of FIGS. **29-41** is used in the exemplary embodiment of the driver **10** of the present application, but may also be applied to other power tools, including power tool drivers.
(98) FIGS. **42-45** illustrate collation for the pipe clamps. FIGS. **42-44** illustrate a first embodiment and FIG. **45** illustrates a second embodiment. Although the collation will be described with respect to the pipe clamp **300**, the collation features can be used on any of the pipe clamps discussed in this application.
(99) The pipe clamps must be loaded into the driver **10**, particularly into the magazine **200** of the driver **10** which feeds them to the nose for driving. For convenience, the pipe clamps may be collated into sticks of multiple pipe clamps, for example, ten to twelve pipe clamps. The pipe clamps are held together rigidly enough for handling, while being able to break apart during firing. That is, when the driver blade **110** drives a pipe clamp, the pipe clamp must separate from the collated stick.
(100) According to the exemplary embodiments, the pipe clamps are held together by an interference fit between features that are part of the plastic clamp portion of the pipe clamps. In particular, there is at least one rib and one pocket on each clamp. The direction of the rib and

pocket are parallel to the drive direction (i.e., the direction in which the pipe clamp is driven into a workpiece). This allows the top pipe clamp in a collated pipe clamp stick to slide off during the driving.

(101) An end view of a pipe clamp **300** with a mechanical collation feature is shown in FIGS. **42-44**. As shown in FIGS. **42-44**, the pipe clamp **300** includes a rear surface **240**. At an upper end of the rear surface **240**, it includes a rib **241**. At a lower end of the rear surface **240**, there is a pocket **242**. Accordingly, as shown in FIG. **42**, the pipe clamps **300** may be assembled together. In particular, the rib **241** of one pipe clamp may be fit, such as by press fit, into a pocket **242** of another pipe clamp **300**. FIG. **42** is a rear perspective view of an assembly of two pipe clamps **300** with the collation feature. FIG. **43** is a rear perspective view of a single pipe clamp **300** with the collation feature and FIG. **44** is a rear plan view of a single pipe clamp **300** with the collation feature. The ribs **241** and pockets **242** are sized such that the ribs **241** and pockets **242** form an interference fit so that the pipe clamps **300** hold together when not under an undue load, but separate when driven by the driver **10**.

(102) FIG. **45** illustrates another exemplary embodiment of a pipe clamp collation feature. In this case, each pipe clamp **300′** includes two ribs and two pockets. In particular each pipe clamp **300′** includes an upward rib **441** and a downward rib **442**. Each pipe clamp **300′** also includes an upward pocket **443** and a downward pocket **444**. The upward rib **441** of one pipe clamp **300′** fits into the downward pocket **443** of an adjacent pipe clamp **300′**. Similarly, the downward rib **442** of one pipe clamp **300′** fits into the upward pocket **444** of an adjacent pipe clamp **300′**. As with the previous ribs and pockets, the pockets and ribs of this exemplary embodiment are configured to press-fit into one another such that the pipe clamps **300′** hold together when not under an undue load, but separate when driven by the driver **10**. The pipe clamp **300′** is similar to the pipe clamp **300** except for the inclusion of two ribs and pocket and the inclusion of a break-away portion. The collation shown in FIG. **19** includes two ribs and pockets, as per the exemplary embodiment of FIG. **45**.

(103) Either exemplary embodiment of the collation features may be included on any of the pipe clamps discussed in this application.

(104) As shown in FIG. **46**, in some embodiments, projections **111** and **112** of the driver blade **110** may be relatively wider than the relative width shown in FIG. **10**. FIG. **46** illustrates a pipe **512** with a foam portion **513** around an inner pipe portion **514**. The inner pipe portion **514** may be hollow and made of plastic, such as PVC pipe. The inner pipe portion **514** may also be made of other materials such as various plastics or metals such as copper. The inner pipe **514** is wrapped with a foam portion **513**. The foam may serve as insulation. As shown in FIG. **46**, having the projections **111** and **112** have a relatively larger width allows them to cut through the foam portion **513**.

(105) In the various embodiments, the projections **111** and **112** may have a width W that is 1 mm or greater; 2 mm or greater; 3 mm or greater; 4 mm or greater; 5 mm or greater; 6 mm or greater; 7 mm or greater; 8 mm or greater; 9 mm or greater; or 10 mm or greater; 15 mm or greater; 20 mm or greater; or 25 mm or greater.

(106) As shown in FIG. **47**, according to another exemplary embodiment, the driver blade **111′** may be a solid flat driver blade **111′** without two separate projections. The driver blade **111′** has a continuous front surface **211** that allows it to be used on staples of different widths, for example, staple **800** shown in FIG. **47**. Staple **800** has a crown **801** and legs **802**. The front surface **211** can be considered as having the dimension E as shown and described with respect to FIG. **10** and the various dimensions of E described in this application. The driver blade **111′** should also otherwise be considered as having the same features and dimensions as the driver blade **111** apart from the distinction regarding the continuous front surface **211** rather than the separate projections **111** and **112**.

(107) As shown in FIG. **47**, rather than having a pair of nails **301**, the various pipe clamps of the present application may instead use a staple, such as staple **800**. In particular, the legs **802** of the

staple **800** are inserted into the receiving portions at either end of the pipe clamp bodies rather than the two discreet nails **301**. The crown **801** of the staple may be spaced from the pipe clamp bodies as shown in FIG. **47** or may be adjacent to or in contact with the pipe clamps. In some embodiments, a groove or other feature may be included to the pipe clamps to accept the crown **801**. The crown **801** may snap fit into the groove. In other embodiments, the staple may be snap fit at other portions of the pipe clamp. In any event, the staple may be secured to the pipe clamp by means such as a snap fit, interference fit, frictional fit or other means.

(108) The exemplary embodiment pipe clamp **320** illustrated by itself in FIG. **17** is shown in the assembly of FIG. **47**, but any of the various other pipe clamp embodiments may be used with a staple such as staple **800** and a flat driver blade **111**′ rather than driver blade **111**. Additionally, it should be noted that flat driver blade **111**′ may be used in place of driver blade **111** regardless of whether the pipe clamp being driven is using nails, a staple or another fastener.

(109) Although the present technology has been described in detail for the purpose of illustration based on what is currently considered to be the most practical and preferred embodiments, it is to be understood that such detail is solely for that purpose and that the technology is not limited to the disclosed embodiments, but, on the contrary, is intended to cover modifications and equivalent arrangements that are within the spirit and scope of the appended claims. For example, it is to be understood that the present technology contemplates that, to the extent possible, one or more features of any embodiment can be combined with one or more features of any other embodiment.

(110) Additionally, while the exemplary embodiment is described with respect to a fastening tool, the methods and configurations may also apply to or encompass other power tools.

Claims

1. A power tool, comprising: a housing; a motor housed in the housing; a transmission driven by the motor; a drive shaft turned by the transmission; a spring engine housed in the housing at an end of the drive shaft opposite the transmission and the drive shaft is linearly disposed between the spring engine and the transmission; a driver blade driven by the spring engine; and a pipe clamp configured to be driven into a workpiece by the driver blade.

2. The power tool of claim 1, wherein the driver blade includes a first projection and a second projection spaced apart from the first projection.

3. The power tool of claim 2, wherein the pipe clamp includes a first nail and a second nail.

4. The power tool of claim 3, wherein the first projection contacts the first nail and the second projection contacts the second nail to drive the pipe clamp.

5. The power tool of claim 1, further comprising a battery pack to power the motor.

6. The power tool of claim 1, further comprising a staple partially housed within the pipe clamp.

7. The power tool of claim 6, wherein the driver blade contacts a crown of the staple when driving the pipe clamp into the workpiece.

8. The power tool of claim 7, wherein the staple includes a first leg and a second leg and the crown connects the first leg and the second leg.

9. The power tool of claim 1, wherein the spring engine comprises at least one drive spring.

10. The power tool of claim 1, wherein the spring engine comprises a pair of drive springs.

11. The power tool of claim 1, further comprising a handle, wherein the motor is disposed in the handle.

12. A pipe clamp driver, comprising: a housing; a motor housed in the housing and driving a drive shaft; a wheel driven by the drive shaft; a carriage driven by the wheel; a spring drive, the spring drive comprising a spring; and a driver blade operatively connected to the carriage and configured to drive a pipe clamp; wherein the drive shaft is linearly disposed between the motor and the wheel, wherein the carriage compresses the spring; and wherein the carriage is driven by the spring to drive the driver blade, whereby the driver blade drives the pipe clamp.

13. The pipe clamp driver of claim 12, wherein the driver blade includes a first projection and a second projection; wherein the first projection is spaced apart from the second projection.
14. The pipe clamp driver of claim 13, wherein the first projection is spaced apart from the second projection by at least twenty millimeters.
15. The pipe clamp driver of claim 13, wherein the first projection is spaced apart from the second projection by at least thirty millimeters.
16. The pipe clamp driver of claim 12, wherein the pipe clamp includes a first nail and a second nail.
17. The pipe clamp driver of claim 16, wherein, when the driver blade drives the pipe clamp, the first projection contacts the first nail and the second projection contacts the second nail.
18. The pipe clamp driver of claim 12, further comprising a staple partially housed within the pipe clamp.
19. The pipe clamp driver of claim 18, wherein the driver blade contacts a crown of the staple when driving the pipe clamp into the workpiece.
20. The pipe clamp driver of claim 19, wherein the staple includes a first leg and a second leg and the crown connects the first leg and the second leg.
21. A pipe clamp driver, comprising: a housing; a motor housed in the housing and driving a drive shaft; a drive wheel driven by the drive shaft; a holder; a locking member secured to the holder in a non-rotatable manner; a carriage driven by the wheel; a spring drive, the spring drive comprising a spring; a driver blade operatively connected to the carriage and configured to drive a pipe clamp; wherein the carriage compresses the spring; wherein the carriage is driven by the spring to drive the driver blade, whereby the driver blade drives the pipe clamp; wherein the drive wheel has a first lock; wherein the locking member has a second lock; and wherein the first lock and second lock cooperate to prevent backdrive of the drive wheel.
22. The pipe clamp driver of claim 21, wherein the locking member is held between the holder and the drive wheel and is axially movable towards and away from the drive wheel.
23. The pipe clamp driver of claim 21, wherein the drive wheel includes at least one projecting pin.
24. The pipe clamp driver of claim 21, wherein the first lock is an indent.
25. The pipe clamp driver of claim 24, wherein the second lock is a ramp.
26. The pipe clamp driver of claim 21, further comprising a biasing member which biases the locking member towards the drive wheel.
27. The pipe clamp driver of claim 26, wherein the biasing member is a spring.
28. The pipe clamp driver of claim 27, wherein the biasing member is a wave spring.
29. A pipe clamp driver system comprising: a pipe clamp driver, the pipe clamp driver comprising a driver blade with a flat front surface, wherein the flat front surface has a width of at least 20 millimeters; and a pipe clamp, the pipe clamp comprising: a pipe clamp body, the pipe clamp body including a first receiving portion and a second receiving portion spaced apart from the first receiving portion; a staple, the staple including a first leg, a second leg, and a crown connecting the first leg and the second leg; wherein the first leg is disposed in the first receiving portion and the second leg is disposed in the second receiving portion; wherein the pipe clamp is driven by the flat front surface of the driver blade.