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- (71) Applicant: **R.J. REYNOLDS TOBACCO COMPANY**
[US/US]; 401 North Main Street, Winston-Salem, North
Carolina 27101-3804 (US).
- (72) Inventor: **TILLEY, Timothy**; 401 North Main Street,
Winston-Salem, North Carolina 27101 (US).
- (74) Agents: **SALAZAR, John F.** et al.; 401 S. Forth Street,
Suite 2600, Louisville, Kentucky 40202 (US).
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(54) Title: CHAIN LINK TESTER

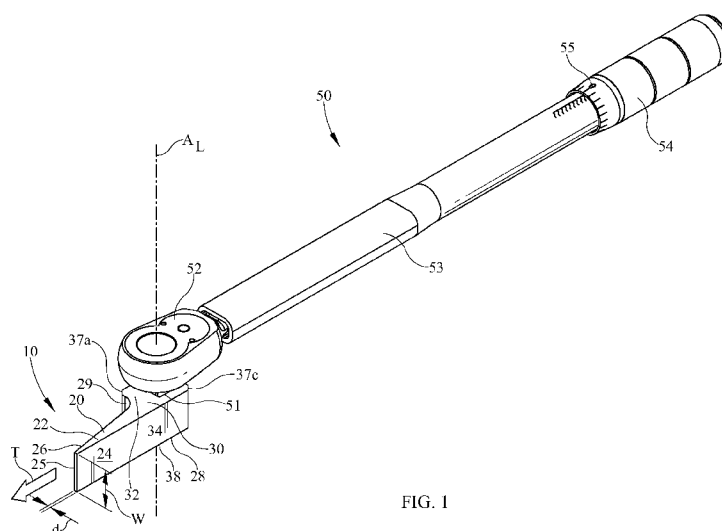


FIG. 1

(57) Abstract: A chain link tester and method of use is disclosed herein. The chain link tester may contain a tapered lever and may be adapted to operatively connect to a torque metering device. The chain link tester may be used to test chain links.

CHAIN LINK TESTER

FIELD OF THE INVENTION

[0001] This international patent application, under the Paris Convention, claims priority to and benefit from, currently pending, U.S. Patent Application Serial Number 13/788,795, filed on 07 March 2013.

[0002] The present invention is related generally to tools for testing equipment, and more specifically to a chain link testing device for chain links.

BACKGROUND OF THE INVENTION

[0003] It is often desirable to drive a conveyor belt using a chain-and-sprocket mechanism or drive. A chain-and-sprocket drive may be used in any of a variety of

applications. Some examples of applications that may employ a chain-and-sprocket drive relate to converting materials from small fibers or pieces into a sheet, mat, or web for processing. One way to do this is to mix the fibers or pieces with water or other liquid into a slurry and then pour the slurry onto a surface so that it may settle into the desired form, which may be a sheet, mat, or web (hereinafter “web”). The extra water or other liquid (hereinafter “liquid”) may then be allowed to dry off, leaving the small fibers or pieces congealed together in the desired web form. In order to decrease the drying time required, and thus improve the efficiency of the process, a dryer may be used. For example, the dryer may be an oven that subjects the slurry to an elevated temperature, thus increasing the evaporation rate of the liquid and decreasing the dry time. For large scale processes, the slurry may be conveyed through the dryer oven at a speed and temperature to evaporate a desirable amount of liquid from the web.

[0004] In some applications using a chain-and-sprocket mechanism to drive a conveyor belt, the chain may be heated when passing through a dryer oven, and then cooled when out of the oven. Repeated heating and cooling of the chain subjects the chain to thermal stresses that challenge the integrity of the chain and thus may shorten the chain’s service life. Chain failure may be especially problematic in large scale operations or operations that are continuous for long periods of time. Down time may be extremely costly to the operator, as production is consequently slowed or stopped. In some applications, a chain may have hundreds or thousands of links and thus be extremely expensive to purchase or replace. Thus, it is desirable to test individual chain links for fatigue or other signs of wear so that, if such signs are found, appropriate remedial action may be taken to, for example, avoid expensive downtime and/or chain replacement.

[0005] Thus, there is a need in the art for a tool that can be quickly and efficiently used to consistently test chain links for signs of fatigue.

SUMMARY OF THE INVENTION

[0006] The presently described embodiments allow an operator to readily test and/or inspect the integrity of individual chain links of a chain, and thereby test and/or inspect the integrity of the overall chain. However, chains in use in some applications, such as, for example, those in use in industrial conveyor belts, may be very long. It may be difficult to consistently and efficiently test a large number of chain links due to, for example, operator fatigue. Thus, various embodiments described herein facilitate testing and/or inspection of the individual chain links by providing a chain link tester that is adapted for use with a torque metering device, such as, for example, a device one might find in a torque wrench or a torque ratchet, that can indicate to an operator when a pre-determined amount of torque has been applied to each chain link. In this way, a consistent amount of torque may be applied to each chain link.

[0007] Therefore, various embodiments provide a chain link tester for consistently testing chain links.

[0008] Additional embodiments described herein provide a chain link tester that is dimensioned to fit and/or wedge between the chain links and the mechanism driving the chain, such as, for example, a sprocket. In some applications, it may be desirable to use a chain and/or a sprocket dimensioned within close tolerances. Thus, it may be desirable to dimension the chain link tester to correspond to the chain and/or sprocket and thereby enhance the consistency and/or the effectiveness of the chain link tester.

[0009] Various alternative structures and applications will become apparent from the following description taken in connection with the accompanying drawings, wherein some embodiments are set forth by way of illustration and examples.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Fig. 1 is a perspective view of an embodiment of a chain link testing device;

[0011] Fig. 2 is a perspective view of the chain link testing device of Fig. 1 engaging a chain and sprocket;

[0012] Fig. 3 is a perspective view of an embodiment of a chain link tester;

[0013] Fig. 4 is a first side view of an embodiment of a chain link tester;

[0014] Fig. 5 is a second side view of an embodiment of a chain link tester.

DETAILED DESCRIPTION

[0015] It is to be understood that the various embodiments described herein are not limited in their application to the details of construction and the arrangement of components set forth in the following description or illustrated in the drawings. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of “including,” “comprising,” or “having” and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless limited otherwise, the terms “connected,” “coupled,” “in communication with” and “mounted,” and variations thereof herein are used broadly and encompass direct and indirect

connections, couplings, and mountings. In addition, the terms “connected” and “coupled” and variations thereof are not restricted to physical or mechanical connections or couplings.

[0016] Furthermore, and as described in subsequent paragraphs, the specific mechanical configurations illustrated in the drawings are intended to exemplify embodiments and other alternative mechanical configurations are possible.

[0017] Referring to Figs. 1 and 2, an embodiment of a chain link tester **10** is illustrated operatively connected to a torque metering device, or torque wrench or torque ratchet, **50**. Chain link tester **10** has a base **30** that is connected to a head **52** of torque wrench **50**. Chain link tester **10** has tapered lever **20** coupled to base **30** and extending outwardly from base **30** to lever end **25**. In Fig. 2, a portion of tapered lever **20** is inserted between a chain **60** and a sprocket **70**. In this way, a force may be applied in a force direction **F** to torque wrench **50** and transferred to a chain link **65** via a portion of chain link tester **10**, wherein force **F** creates a reactionary torque or force at the chain link **65**. This reactionary torque or force may be used to test the integrity and/or strength of the chain link **65** by, for example, causing the chain link to crack or split or otherwise show a sign of failure, or causing any existing cracks or splits or other sign of failure to become exaggerated.

[0018] Any of a variety of torque metering devices may be used in connection with chain link tester **10**. It is understood that the Figures merely illustrate one embodiment of a torque metering device. It may be desirable, however, to provide a torque metering device, such as torque wrench **50**, having a handle **54**, a dial **55**, a body **53**, head **52**, and engaging extension **51**. Some such torque wrenches or ratchets may be

commercially available, for example, from any of a variety of tool retailers or home improvement stores. In the embodiments illustrated, head **52** includes a torque limiting device for limiting the amount of torque that may be transmitted through it from body **53** and/or handle **54** to engaging extension **51** and to chain link tester **10**. Head **52** also includes an indicator, or torque metering device, to alert the operator when a pre-determined amount of torque is applied to head **52**. The indication made by the indicator may be any of a variety of indications, including, but not limited to, audible, such as, for example, a click, pop, buzz, or other noise; it may be visible, such as a light, a gauge, or metering device; the indication may be directed at a sense other than hearing or sight, such as, for example, feel, wherein the indication may be, for example, slip or vibration; the indication may be an electronic, digital, radio, or any other type of signal, which in turn may be transmitted or communicated to another device; or the indication may be any combination thereof. Dial **55** may be used to set the pre-determined torque. Handle **54** may provide a convenient and/or comfortable grip for a human operator, who may apply a force at handle **54** in force direction **F**. It is understood that a force may be applied at or near handle **54** or virtually anywhere on torque wrench **50**, although it may be desirable to apply the force at handle **54** to optimize the reactionary force on the chain link **65** and/or sprocket **70**. It is further understood that a force may be applied by a machine or by automated equipment.

[0019] Base **30** has a socket, or channel or aperture, **40** for operatively connecting to engaging extension **51** of head **52**. Socket **40** is adapted to removably accept an engaging extension **51** extending from head **52**. Socket **40** is dimensioned and configured to slideably engage, or allow insertion to an operative depth of, engaging

extension **51**. Thus, base **30** may be removable from and/or transmit torque to or from engaging extension **51**. The operative depth may be a depth of insertion of engaging extension **51** into socket **40** to allow the transfer of torque from engaging extension **51** to socket **40**, or vice versa. It is understood that one or more engaging extensions **51** may engage one or more sockets **40**.

[0020] Referring now to Figs. 3-5, chain link tester **10** is illustrated having tapered lever **20**, base **30**, and socket **40**. Socket **40** has a longitudinal axis A_L and is sized and configured to connect to engaging extension **51** of torque wrench **50**. Base **30** has a first side **32**, a first surface **34**, a second side **38**, a third side **36**, a fourth side **35**, as well as first, second, and third chamfers **37a**, **37b**, **37c**, any or all of which, along with a corner radius **29** and/or tapered lever **20**, may be included to substantially define the outer periphery of base **30**. Socket **40** extends along longitudinal axis A_L through first side **32** and second side **38**, wherein longitudinal axis A_L is substantially parallel to first surface **34**. It is understood that socket **40** need not extend through both first side **32** and second side **38**, and in some embodiments may only extend through either first side **32** or second side **38**. However, it may be desirable that socket **40** extend through base **30** so that it may be connected to torque wrench **50** in more than one orientation. For example, in this embodiment, base **30** may be connected to torque wrench **50** with either first side **32** or second side **38** near, or adjacent to, torque wrench **50**, thereby effectively allowing more orientations for operative connection to torque wrench **50**. It is understood that handle **53** and a taper direction **T** need not be substantially parallel, as shown, and may be transverse or perpendicular to one another.

[0021] Socket **40** has a substantially square cross-section to correspondingly accept, or mate with, engaging extension **51** that similarly has a substantially square cross-section. It is understood that socket **40** may be any of a variety of shapes, sizes, and/or configurations, although it may be desirable to correspond with engaging extension **51** and/or to have at least one non-circular side to prevent rotation of engaging extension **51** within socket **40**. For example, socket **40** and engaging extension **51** may have a cross-section or shape that is square, rectangular, triangular, hexagonal, octagonal, otherwise polygonal, trapezoidal, ovular, or any other shape. In some embodiments, chain link tester **10** may have, instead of or in addition to socket **40**, an extension member that extends outwardly from base **30** along or parallel to longitudinal axis **A_L**, wherein the extension member may be adapted to connect to, for example, a socket of a torque metering device, or a dual socket that accepts it and an extension from a torque metering device such as engaging extension **51**, or otherwise operatively connected to a torque metering device.

[0022] Chamfers **37a**, **37b**, **37c** may be located at interfaces of corner radius **29** and third side **36**, of third side **36** and fourth side **35**, and of fourth side **35** and first surface **34**, respectively. Chamfers **37a**, **37b**, **37c** are not required in some embodiments, but may be desirable for, among other things, eliminating sharp edges and discomfort or injury from handling chain link tester **10**, or for aiding in production of chain link tester **10**, or for any other reason. It is understood that corner radius **29** need not extend to chamfer **37a**, and one or more interposing sides, surfaces, or other features may be disposed between chamfers **37a**, **37b**, **37c** and sides **35**, **36**, first surface **34**, and/or corner radius **29**. While base **30** is illustrated in the Figures as substantially box-like, it is

understood that base **30** need not be box-like and, in some embodiments, may take any of a variety of forms and/or shapes, including, but not limited to, prismatic, cylindrical, round, spherical, bulbous, obloid, and/or any combination thereof. For example, in a bulbous or spherical form, base **30** may have only one substantially continuous outer surface, through which socket **40** may extend in one or more locations. Further, each of sides **32**, **38**, **36**, **35** and first surface **34** may have a shape or form that is the same as, similar to, or distinct from, the others.

[0023] In some embodiments, tapered lever **20** may be coupled to base **30**. Tapered lever **20** may be formed as one integral unit also including base **30**, as illustrated, but, in some embodiments, tapered lever **20** may be otherwise connected or coupled to base **30**. Corner radius **29** may be included in some embodiments for a variety of reasons, including, but not limited to, reducing stress concentrations at the interface of tapered lever **20** and base **30**. Tapered lever **20** may include a first surface **24**, a second surface **26**, a first side **22**, and a second side **28**. Tapered lever **20** may further include a narrowing taper from base **30** to lever end **25** in taper direction **T**, formed by the angled relationship of first surface **24** and second surface **26**. Tapered lever **20** may have a width **W** measured from first side **22** to second side **28** and perpendicular to taper direction **T**. Tapered lever **20** may also have a depth **d** measured from first surface **24** to second surface **26** and perpendicular to taper direction **T** and/or width **W**. Width **W** and/or depth **d** may be sized and configured to be inserted and engage one or more chain links **65** and/or sprocket **70** while chain link **65** is engaging sprocket **70** as, for example, chain link **65** may engage sprocket **70** during operation of a chain-and-sprocket drive. The narrowing taper may allow tapered lever **20** to be easily inserted between chain **60**

and sprocket **70** (see Figs. 1 and 2). Sprocket **70** may be attached to, connected to, and/or driven by being coupled or connected to a driver, such as, for example, a drive shaft or axle, at or near sprocket hub **75**. The taper formed by tapered lever **20** may desirably be designed and/or made to optimize insertion and force application to a specific or pre-determined chain **60**, sprocket **70**, or the combination thereof. In this way, performance of chain link tester **10** may be optimized for a specific chain and/or sprocket that is being used in an application, such as, for example, an industrial dryer or other application.

[0024] Although it is not necessary that first surface **24** be planar as shown, it may be desirable in some embodiments that first surface **24** be planar to optimize the ease of insertion, the ability to meet relatively tight tolerances of chain **60** and/or sprocket **70**, and/or the application of torque to the chain links **65** (see Fig. 2). First side **22** and second side **28** may be formed or dimensioned so that width **W** is smaller than a distance between sprocket teeth **72** and/or the length of chain link **65** to allow insertion of tapered lever **20** between a chain link **65** and sprocket **70**. Further, width **W** and/or depth **d** may correspond to a certain or specified chain **60**, chain link **65**, sprocket **70** and/or sprocket tooth **72**. In some embodiments, first side **22** and second side **28** may be angled relative to each other to form a narrowing taper in addition to or in lieu of the narrowing taper formed by first and second surfaces **24**, **26**. Lever end **25** is shown as substantially flat, but also may be pointed, rounded, or any of a variety of shapes or combinations thereof. In some embodiments, either or both of first and second surfaces **24**, **26** may be angled, bent, or hooked, instead of substantially straight as shown. First surface **24** of tapered lever **20** and first surface **34** of base **30** are illustrated as co-planar, but it is understood that they do not need to be co-planar.

[0025] In use, chain link tester **10** may be provided and operatively connected to torque wrench **50** to allow transfer, or transmission, of torque to chain link tester **10** from a force applied in force direction **F** to torque wrench **50**. Torque wrench **50** may be set to indicate when a desired, or pre-determined, amount of torque is applied thereto or to prevent or resist the transmission of more than the pre-determined amount of torque. The pre-determined amount of torque may be set by, for example, dial **55** or any other of a variety of adjusting, adjustable, or setting mechanisms. Chain link tester **10** may be caused to connect to torque wrench **50** by an operator or other individual or machine, or chain link tester **10** may be pre-connected to torque wrench **50**. Chain link tester **10** may be inserted between chain **60** and sprocket **70**, and/or between chain links **65** and sprocket teeth **72** by, for example, inserting lever end **25** until creating a wedge with either first surface **24** or second surface **26** contacting either chain **60** or sprocket **70**, and the other of first surface **24** and second surface **26** contacting the other of chain **60** and sprocket **70**. A force may be applied to torque wrench **50**, for example at handle **54**, in a force direction **F** to create a torque, or moment, about an axis parallel to or collinear with longitudinal axis **A_L**. The force applied to torque wrench **50** and/or a resulting torque may be transferred via said torque wrench **50** to chain link tester **10**. The torque applied to chain link tester **10** may be metered, or measured, by torque wrench **50** to determine when an ascertainable or pre-determined amount of torque is being applied to chain link tester **10**. Torque wrench **50** may indicate when the ascertainable or pre-determined amount of torque is applied to chain link tester **10** in any of a variety of ways, including, but not limited to audibly, visually, sensibly, or otherwise, such as, for example, as described herein. It is understood that one or more chain links **65** may be tested at once,

and that one chain link tester **10** may be made to test more than one chain link **65** at a time. Further, any or all of these steps may be repeated or repeatable to, for example, test an entire length of chain **60**. It should also be understood that particular or partial steps may be automated.

CLAIMS

I claim:

- 1 1. A method for testing individual chain links in a chain, comprising:
2 providing a chain link tester operatively connected to a torque metering device;
3 inserting a lever of said chain link tester between a chain link and a sprocket, said
4 chain link engaging said sprocket;
5 using said torque metering device to apply a torque to said chain link tester; and
6 using said torque metering device to determine when a pre-determined amount of
7 torque has been applied to said chain link tester.
2. The method of claim 1 further comprising the step of providing an
indication when said pre-determined amount of torque is applied to said chain link.
3. The method of claim 1 further comprising the step of adjusting a setting
mechanism on said torque metering device to vary said pre-determined amount of torque.

1 4. An apparatus for testing individual chain links in a chain, comprising:
2 a chain link tester having a base and a tapered lever that is insertable between an
3 individual chain link and a sprocket while said individual chain link is
4 engaging said sprocket;
5 said tapered lever having a pair of opposed surfaces extending outwardly from
6 said base;
7 said base rigidly coupled to said tapered lever, said base having a channel; and
8 a torque metering device operatively connected to said chain link tester.

5. The apparatus of claim 4 wherein said torque metering device includes an indication when a pre-determined amount of torque has been applied to said torque metering device.

6. The apparatus of claim 5 wherein said indication is a meter.

7. The apparatus of claim 4 wherein at least one of said opposed surfaces is substantially planar.

8. The apparatus of claim 7 wherein said channel has a longitudinal axis parallel to said at least one planar surface.

9. The apparatus of claim 8 wherein said channel extends through said adapter.

1 10. An apparatus for testing individual chain links in a chain, comprising:
2 a chain link tester having a base and a tapered lever that is insertable between an
3 individual chain link and a sprocket while said individual chain link is
4 engaging said sprocket;
5 said tapered lever having a pair of opposed surfaces extending outwardly from
6 said base;
7 a base rigidly coupled to said tapered lever; and
8 an extension member extending outwardly from said chain link tester and adapted
9 to operatively connect to a torque metering device.

11. The apparatus of claim 10 wherein said torque metering device includes
an indication when a pre-determined amount of torque has been applied to said torque
metering device.

12. The apparatus of claim 11 wherein said indication is a meter.

13. The apparatus of claim 10 wherein at least one of said opposed surfaces is
substantially planar.

14. The apparatus of claim 13 wherein said extension member extends in a
longitudinal direction parallel to said at least one planar surface.

1 15. A chain link testing apparatus, comprising:
2 a tapered lever having a narrowing taper in a taper direction;
3 said tapered lever having a width dimension perpendicular to said taper
4 direction, said width dimension sized and configured to fit between
5 chain links;
6 a base rigidly coupled to said tapered lever and having at least one surface and an
7 aperture suitable for removably attaching said base to a torque metering
8 device;
9 said aperture extending in a longitudinal direction through said at least one
10 surface;
11 said longitudinal direction substantially perpendicular to said taper
12 direction; and
13 said narrowing taper of said tapered lever narrowing away from said base.

16. The chain link testing apparatus of claim 15 wherein said base is
operatively connected to said torque metering device.

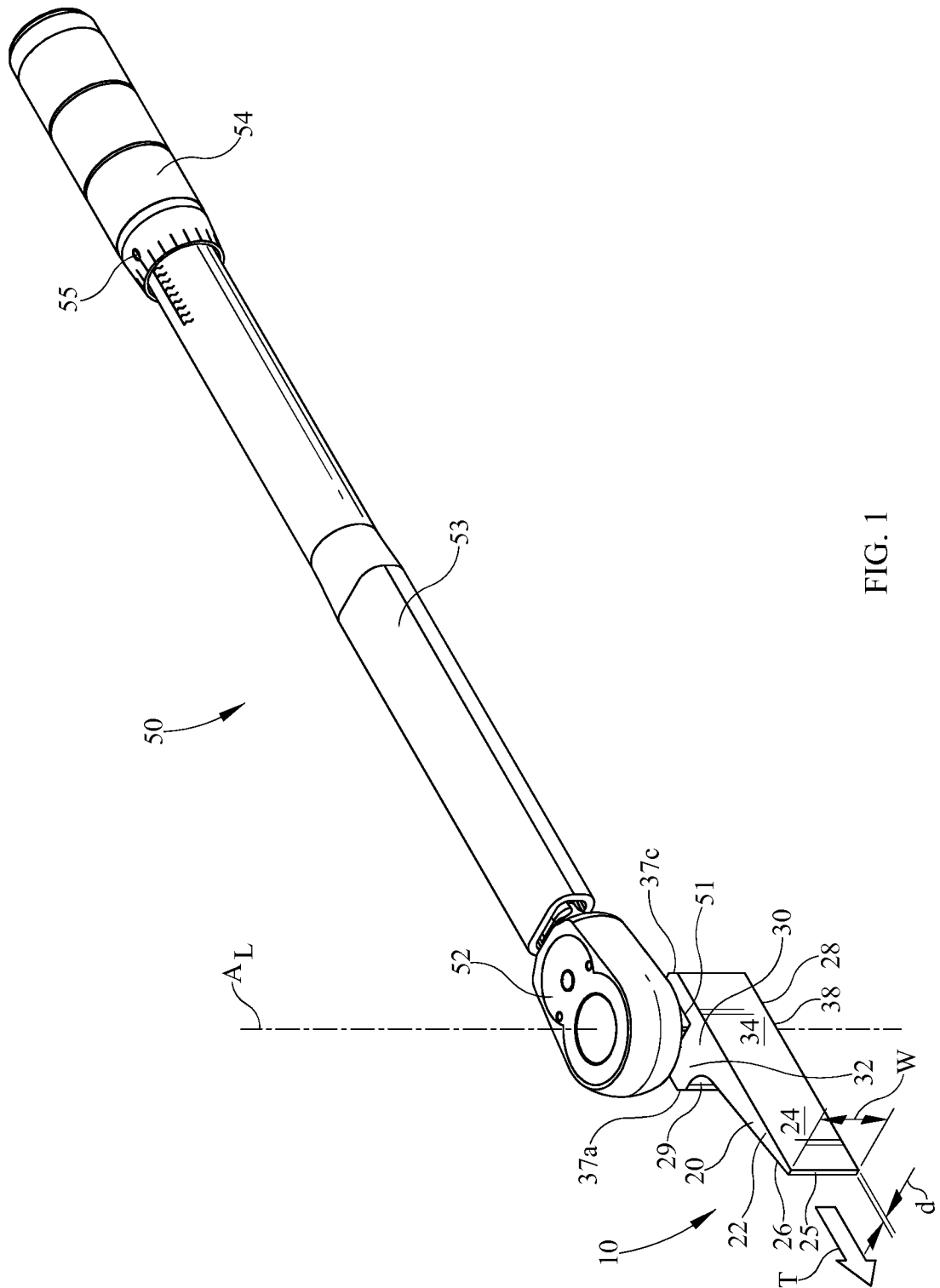


FIG. 1

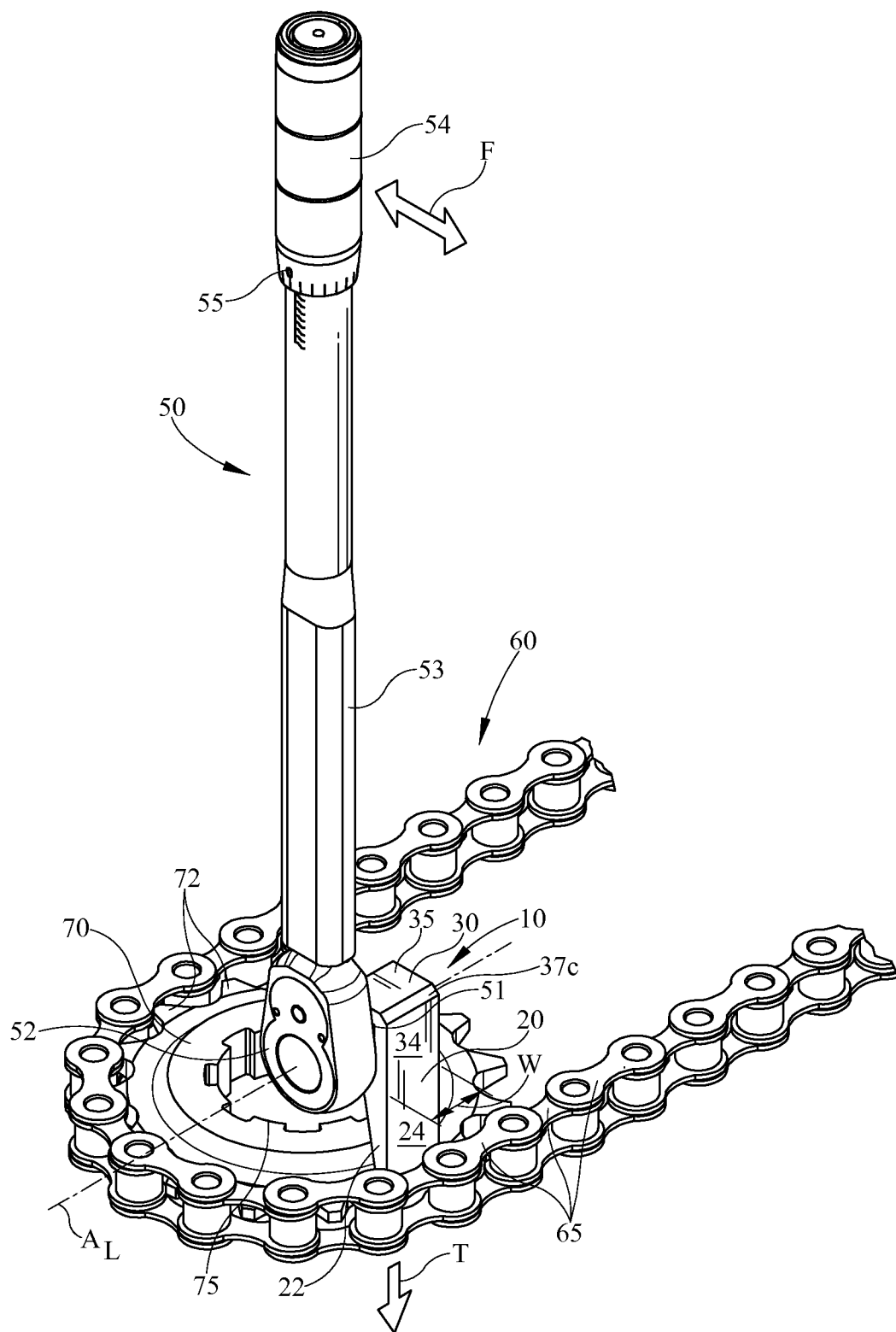


FIG. 2

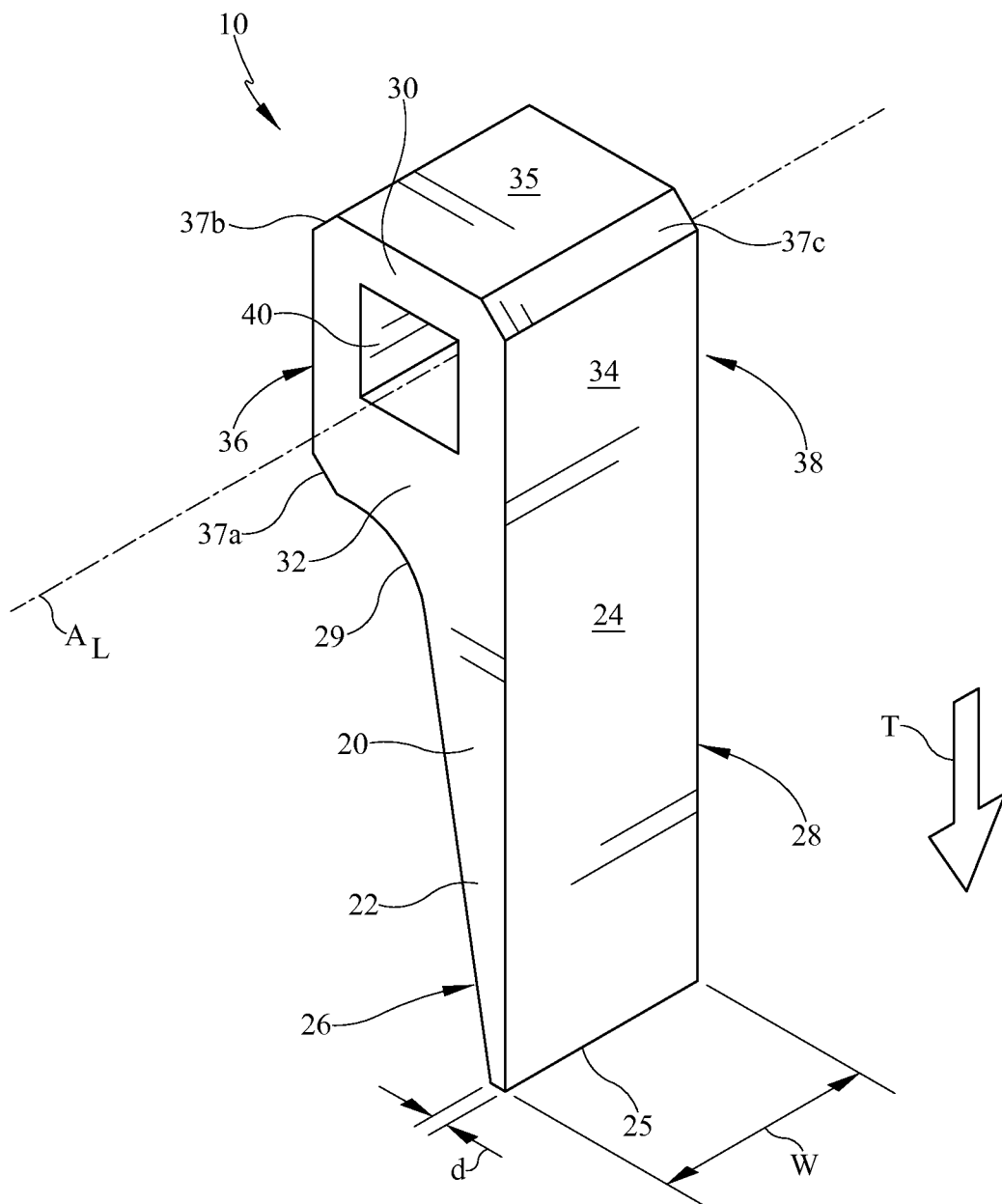


FIG. 3

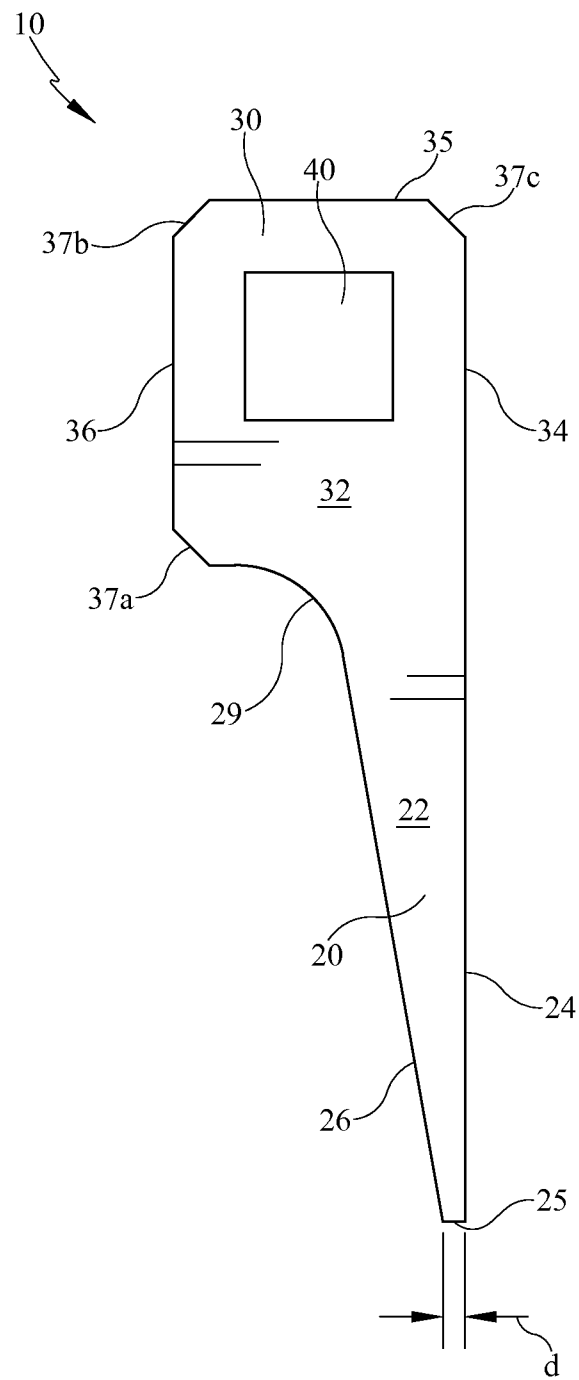


FIG. 4

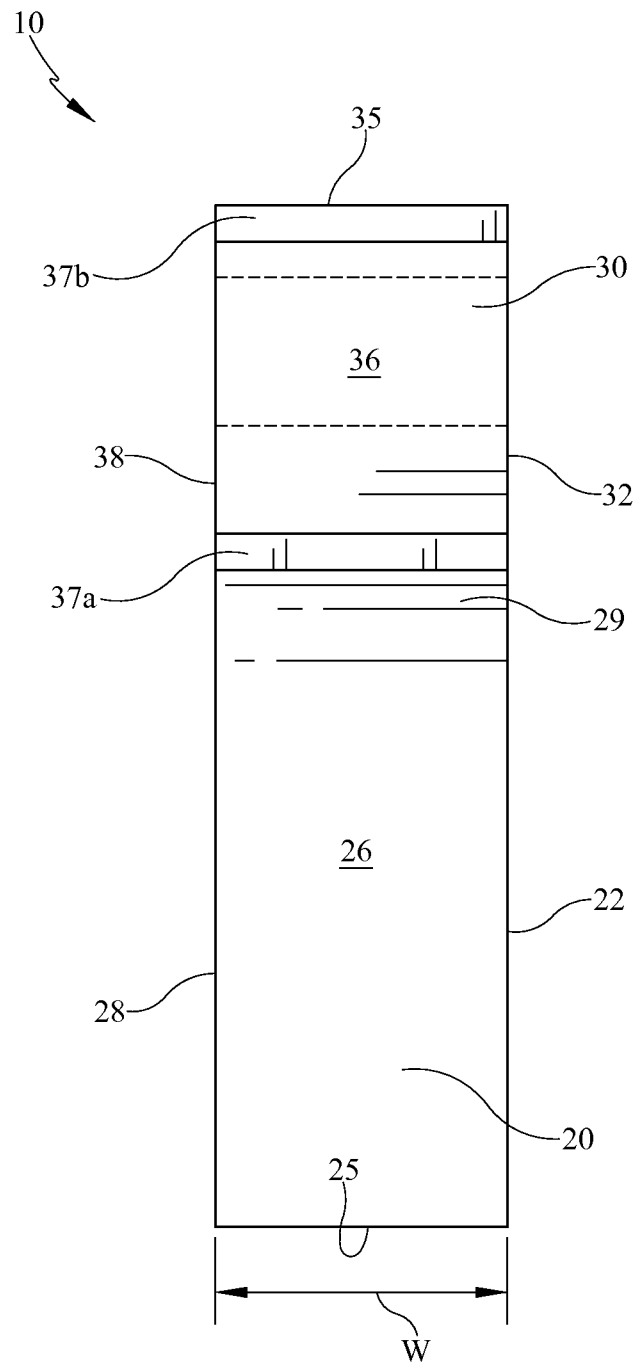


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/020665**A. CLASSIFICATION OF SUBJECT MATTER****G01M 13/02(2006.01)i, G01L 5/06(2006.01)i, G01N 3/08(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G01M 13/02; G01N 19/02; A24B 5/10; A47C 1/02; G01N 27/90; G01L 5/06; G01N 3/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & keywords: chain, torque, link, tester, lever, tapered, narrow, sprocket and conveyor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2012-026826 A1 (ARGUS REMOTE SYSTEM AS.) 01 March 2012 See abstract; pages 7-9; claims 1-3 and figures 1-3.	1-16
A	US 6361111 B1 (BOWERS et al.) 26 March 2002 See abstract; column 7, line 8 - column 8, line 40 and figures 5-8.	1-16
A	US 3972221 A (NATENS et al.) 03 August 1976 See abstract; column 3, line 49 - column 4, line 54 and figures 1-4.	1-16
A	US 2011-0271969 A1 (BULLINS et al.) 10 November 2011 See abstract; paragraphs 29-35 and figures 1-8.	1-16
A	JP 2004-020453 A (SUGIKOU K.K.) 22 January 2004 See abstract; paragraphs 11-19 and figures 1-8.	1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

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Authorized officer

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/020665

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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