The invention relates to indentation vise-wrenches; in use, interlocking pushed-out areas ("exdentations")/pushed-in areas ("indentations") of a fitting's inner surface/a pipe's outer surface are created by indenting units at indentation vise-wrenches' jaws. Neither pipes nor fittings of interlocked pipe-fitting combinations will move with respect to each other; even after total separation between the indentation vise-wrench and the interlocked combination. Embodiments include a tool comprising an indentation vise wrench; a tool kit comprising a set having at least two indentation vise-wrenches; a process comprising making indentation vise-wrenches; a process of interlocking pipe-fitting combinations; etc.
FIG. 4

See Fig. 5B

FIG. 4A

FIG. 4B

FIG. 4C

FIG. 4D

See Alternate Embodiments Figs 4A, 4B, 4C, 4D
INDENTATION VISE-WRENCHES

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] Main Idea. The invention is generally directed to hand tools commonly called vise-wrenches (sometimes known as locking pliers, lockjaw pliers, plier-wrenches, toggle-wrenches, vise-grips, etc.) generally having a pair of two jaws (stationary/movable), a pair of two handles (stationary/movable), and mechanisms for locking, releasing, and adjusting (e.g., a torsion spring, a toggle link, a toggle release lever, a threaded adjusting screw, etc.). Generally, the pair of two jaws and the pair of two handles are relatively movable; in use, manipulative movement of the handles with respect to each other effects relative movement of the jaws, and in turn, the jaws can fully engage with or fully disengage from articles, items, or objects (“work”) between the jaws. With this background and in more detail, the invention relates to indention vise-wrenches with indenting units at jaws which can interlock pipe-fitting combinations. Even after an interlocked combination is totally separated from an indented vise-wrench, the combination remains interlocked into a permanent, definitive position in which neither the inner pipe nor the outer fitting will move with respect to each other. Interlocking pipe-fitting combinations is achieved via matched pushed-out areas (“indentations”) at a fitting’s inner surface and pushed-in areas (“indentations”) at a pipe’s outer surface that are created by indenting units of indentation vise-wrenches.

[0003] 2. Background Art


[0005] Routine Vise-Wrenches. Routine vise-wrenches, including the manner in which component parts are generally operatively interconnected, are generally known; however, they do not fairly disclose/suggest the invention; they cannot interlock pipe-fitting combinations; nor do they have any indenting units or centering units. Notwithstanding these differences, many parts are common to routine/indentation vise-wrenches; generally, such common parts perform the same or similar functions in the same or similar manners. Generally, routine vise-wrenches have structural elements including a stationary jaw, a stationary handle, a movable jaw, a movable handle, a torsion spring, a toggle link, a toggle release lever, four pivot pins, and a threaded adjusting screw. The stationary jaw-handle together comprise a stationary arm; likewise, the movable jaw-handle together comprise a movable arm. Each jaw has an interior surface that includes a gripping member. A locking mechanism and a releasing mechanism each use “dead center point” alignment principles to implement their respective functions; locking primarily involves the torsion spring and the toggle link; releasing primarily involves the torsion spring, the toggle link, and the toggle release lever. An adjusting mechanism relies upon the ability of the toggle link’s free-end to slideably move within a slot at the interior side of the stationary handle. The torsion spring has an upper end connecting with the movable jaw and a lower end connecting with the stationary handle. The toggle link has an upper pivot-end, a middle section with a notch, and a lower free-end. The toggle link’s pivot-end connects the toggle link and the movable handle; the toggle link’s free-end meets the threaded adjusting screw’s contacting-end. A toggle release lever has an upper tipping-end, a middle pivoting point, and a lower actuating-end. A first pivot pin connects the movable handle and the movable jaw; a second pivot pin connects the movable handle and the movable jaw; a third pivot pin connects the movable handle and the toggle link’s pivot-end; and a fourth pivot pin connects the movable handle and the toggle link’s pivot-end. The threaded adjusting screw has an upper contacting-end, a middle section with threads, and a lower knurled-end; the contacting-end meets the toggle link’s free-end; the threads are functionally engaged with an aperture at the stationary handle’s lower end; and the knurled-end is outside the stationary handle’s lower end. The torsion spring biases the movable jaw against the stationary handle and the toggle link’s free-end against the threaded adjusting screw’s contacting-end; this biasing action normally keeps jaws/handles open. Rotationally turning the threaded adjusting screw’s knurled-end causes corresponding lateral movement of the threaded adjusting screw’s contacting-end, and in turn, this causes corresponding lateral movement of the toggle link’s free-end. In operation, a user’s manipulation of the threaded adjusting screw’s knurled-end presets distances between the pair of open jaws (when handles are unsqueezed) and the pair of closed jaws (when handles are squeezed). After a user appropriately adjusts the threaded adjusting screw’s knurled-end, full-engagement (locking) of the gripping members with work is achieved by squeezing the handles.
When handles are squeezed, the second pivot pin, the third pivot pin, and the toggle link’s free-end assume dead center point alignment as gripping members fully-engage work. Prior to full-engage, the relative arrangement of the second pivot pin, the third pivot pin, and the toggle link’s free-end is an obtuse angle (an angle greater than 90°); at full-engage it is linear (an angle of 180°). Due to bias action of the torsion spring, if a user does not continue squeezing during partial-engage, then the jaws/handles will spring open. At full-engage, dead center point locking prevents the jaws/handles from springing open even if the user stops squeezing; each jaw’s gripping member will continue to tightly contact/engage work. By pressing upon the toggle release lever’s actuating-end, a user causes the toggle release lever to pivot at the fourth pivot pin, and in turn, this causes the toggle release lever’s tipping-end to push against the toggle link’s middle notch. The second pivot point is then pushed off dead center point alignment so the jaws/handles will spring open. Once a user relatively manipulates/squeezes handles to effect full-engage of jaws with work, then (in the absence of purposeful or unintentional unlocking), starting from that point in time and continuing thereafter the two handles may be further manipulated together as a unit, similar to a wrench handle, to transmit such further manipulation to the work (e.g., a user twists the fully-engaged work by twisting as a unit the two handles).

[0006] Operations Other Than Interlocking. Crimping, cutting, or puncturing techniques, sometimes relating generally to hand tools, are generally known. However, such techniques do not fairly disclose/suggest the invention, each technique is discussed below.

[0007] Crimping. Regarding crimping, the following distinctions are explained. Crimping typically mechanically deforms/compresses most if not the larger object’s periphery inward to thereby engage most if not all of the smaller object’s periphery (in effect: pinpoint-type crimping does not occur); this is achieved by engagement of most if not all of the larger object’s periphery with crimping elements/crimping jaws. Interlocking creates matched pinpoint-type indentations/indentations; this is achieved by engagement of only a miniscule fraction (e.g., two pinpoint-type impacting locations) of a positioned pipe-fitting combination’s outer surface with indenting units. Also, crimping typically uses crimping elements/crimping jaws configured such that either both crimping elements/crimping jaws curve inward and thus do not project outward or any crimping element/crimping jaw which curves outward is paired with a corresponding crimping element/crimping jaw which curves inward. Indenting units project upward from jaws; they do not curve inward. Also, crimping typically involves bulk-deformation of cramped objects (e.g., crushing-inward from round-shaped to egg-shaped). Interlocking does not, and purposely must not, cause any such bulk-deformation; a round-shaped pipe-fitting combination must remain round-shaped (not egg-shaped) even after it has been interlocked. Also, crimping typically is not followed with subsequent sealing-type operations; a crimped connection is not subject to follow-up treatment. Interlocking does not create final seals (gas/liquid-tight) of pipes/fittings; follow-up techniques such as brazing, soldering, or sweating are needed. Also, crimping typically is used in different environments (e.g., connections relating to electricity, consumer electronics, fax machines, televisions, telephones, computers, etc.). Interlocking environments involve pipe/fitting combinations, not electrical connections. Also, some crimping operations use objects containing pre-existing, crimp-like parts upon which the crimping will be effected. Interlocking does not use any such pre-existing, crimp-like parts in inner pipes/outer fittings. US patent documents relating to various crimping operations include U.S. Pat. Nos. 7,024,911B2, 6,807,840B2, and 6,748,617B1. Regarding U.S. Pat. No. 7,024,911B2, two crimping elements (labeled “M1” and “M2” in the drawings) are included; each crimping element is configured as a recessed area that curves inward in the approximate shape of a square halved along its diagonal. Regarding U.S. Pat. No. 6,807,840B2, the disclosed crimping tool relies upon a four-mandrel principle which involves four crimping punches (labeled as “13” in the drawings); a threaded spindle (7); a setting wheel (8); a threaded bush (9); a pivoting plunger (4); and control cam (12). The disclosed crimping tool is operationally different from routine vise-wrenches and it is sized for use with electrical connectors (e.g., wire connections in the 2 millimeter range). Regarding U.S. Pat. No. 6,748,617B1, each crimping element (labeled “4” in the drawings) is an inward-curving recessed area at a jaw. The disclosed tool lacks any locking, releasing, or adjusting mechanisms.

[0008] Cutting. Regarding cutting, the following distinctions are explained. Cutting typically severs and separates larger articles into smaller articles in which the smaller articles, at least partially, are no longer integral with each other. Indenting units do not cut pipes/fittings; rather indenting units create interlocking junctions which are not equivalent to cuts formed by cutting techniques.

[0009] Puncturing. Regarding puncturing, the following distinctions are explained. Neither pushed-out areas (indentations) nor pushed-in areas (indentations) are equivalent to holes formed by puncturing techniques. US patent documents relating to various puncturing operations include U.S. Pat. Nos. 5,301,352 and 5,291,914. Regarding U.S. Pat. No. 5,301,352, the disclosure includes a tube piercing assembly on the jaws of pliers; its primary intended use is for the vacuum assisted evacuation of refrigerant gases from tubing lines of refrigeration and air conditioning systems. Regarding U.S. Pat. No. 5,291,914, the disclosure includes pliers modified to include a piercing valve assembly for purposes including the withdrawal/recovery of fluid from pipes.

BRIEF SUMMARY OF THE INVENTION

[0010] Presence/Function Of Indenting Units. The invention covers hand tools that are referred to herein as “indentation vise-wrenches”. Indentation vise-wrenches, like routine vise-wrenches, can fully-engage work between jaws. Unlike routine vise-wrenches, indentation vise-wrenches (when fully-engaged with positioned pipe-fitting combinations) create with jaws’ indenting units at the moment of full-engage interlocking junctions. After interlocking—even after an indentation vise-wrench and a pipe-fitting combination are totally separated—neither the pipe nor the fitting will be movable with respect to each other because of the interlocking junctions. The invention also encompasses related embodiments (e.g., tool kits with at least two indentation vise-wrenches; tool kits with an indentation vise-wrench together with a soldering product; processes for making indentation vise-wrenches; processes for interlocking pipe-fitting combinations with indentation vise-wrenches; etc.)
BRIEF DESCRIPTION OF DRAWINGS

[0011] Listing Of Drawings. Six Drawing Sheets have a total of twenty drawings (FIGS. 1, 2, 2A, 2B, 2C, 2D, 2E, 2F, 2G, 3, 3A, 4, 4A, 4B, 4C, 4D, 5A, 5B, 6A, and 6B); Drawing Sheet 1 of 6 has one drawing (FIG. 1); Drawing Sheet 2 of 6 has eight drawings (FIGS. 2, 2A, 2B, 2C, 2D, 2E, 2F, and 2G); Drawing Sheet 3 of 6 has two drawings (FIGS. 3 and 3A); Drawing Sheet 4 of 6 has five drawings (FIGS. 4, 4A, 4B, 4C, and 4D); Drawing Sheet 5 of 6 has two drawings (FIGS. 5A and 5B); and Drawing Sheet 6 of 6 has two drawings (FIGS. 6A and 6B).

[0012] FIG. 1 shows an elevation view of a routine vise-wrench.

[0013] FIG. 2 shows an elevation view of an indentation vise-wrench.

[0014] FIG. 2A shows in isolation an enlarged detail elevation view of an indenting unit at a jaw’s interior surface.

[0015] FIG. 2B shows in isolation an enlarged detail end view of an indenting unit at a jaw’s interior surface.

[0016] FIG. 2C shows in isolation an enlarged detail elevation view of a centering unit.

[0017] FIG. 2D shows in isolation two enlarged detail elevation/end views of an indenting unit with a circle-shaped endpoint.

[0018] FIG. 2E shows in isolation two enlarged detail elevation/end views of an indenting unit with a point-shaped endpoint.

[0019] FIG. 2F shows in isolation two enlarged detail elevation/end views of an indenting unit with a cross-shaped endpoint.

[0020] FIG. 2G shows in isolation two enlarged detail elevation/end views of an indenting unit with a line-shaped endpoint.

[0021] FIG. 3 shows an elevation view of an indentation vise-wrench partially-engaged with a pipe-fitting combination.

[0022] FIG. 3A shows in isolation an elevation view of a centering unit with size markings.

[0023] FIG. 4 shows an elevation view of an indentation vise-wrench fully-engaged with a pipe-fitting combination.

[0024] FIG. 4A shows in isolation an elevation view of a threaded adjusting screw at the stationary handle’s lower end.

[0025] FIG. 4B shows in isolation an elevation view of a threaded adjusting screw with size markings at the stationary handle’s lower end.

[0026] FIG. 4C shows in isolation an elevation view of a threaded adjusting screw with a locking nut at the stationary handle’s lower end.

[0027] FIG. 4D shows in isolation and as alternatives an elevation view of three threaded adjusting screws of different sizes.

[0028] FIG. 5A shows in isolation and taken from FIG. 3 an enlarged detail elevation view of an indentation vise-wrench partially-engaged with a pipe-fitting combination.

[0029] FIG. 5B shows in isolation and taken from FIG. 4 an enlarged detail elevation view of an indentation vise-wrench fully-engaged with a pipe-fitting combination.

[0030] FIG. 6A shows in isolation an enlarged detail/partial cross section elevation view of an indentation vise-wrench fully-engaged with an interlocked pipe-fitting combination.

[0031] FIG. 6B shows in isolation an enlarged detail/partial cross section elevation view of an interlocked pipe-fitting combination during later soldering.

DETAILED DESCRIPTION OF THE INVENTION

[0032] Basic Terminology. Certain expressions are explained in alphabetical order: “fitting” refers to a fitting (alternatively, “outer fitting”) having a larger inner diameter in relation to a pipe’s smaller outer diameter and capable of enclosing therein the pipe, at least partially; “interlocked combination” refers to a pipe-fitting combination that has been positioned and interlocked; “interlocking” refers to using an indentation vise-wrench with a positioned combination to create an interlocking junction which thereby interlocks the pipe-fitting combination into a permanent, definitive position in which neither the pipe nor are movable; “pipe” refers to a pipe (alternatively, “inner pipe”) having a smaller outer diameter in relation to a fitting’s larger inner diameter and capable of being enclosed by the fitting, at least partially; “pipe-fitting combination” refers to any particular combination of a given pipe and a given fitting suitable for interlocking; “positioned combination” refers to a pipe-fitting combination with the outer fitting and the inner pipe arranged/orientated for immediate interlocking; “routine vise-wrench” refers to any known operative vise-wrench other than an indentation vise-wrench; and “sealing” refers to conventional sealing techniques typically used to make pipe-fitting combinations gas/liquid-tight (e.g., brazing, soldering, sweating, etc.). Position combinations have relative properties (e.g., sizes, orientations, compositions, dimensions such as thickness of walls, etc.) such that in an overlap area at least a portion of the pipe is snugly enclosed within a least a portion of the fitting and the compositions/dimensions of both the pipe and the fitting are such that interlocking junctions can be created.

[0033] Structural Elements. Indentation vise-wrenches have operatively interconnected structural elements including a stationary jaw; a stationary handle, a movable jaw, a movable handle, a toggle link, a toggle release lever, an abutting unit comprising a threaded adjusting screw or a backing unit, and indenting units at jaws; centering units are optional.

[0034] Overview Of Indenting Units. Indenting units refer to raised, strong, hard, tough, rigid areas at jaws capable of contacting, engaging, and applying indenting pressure/force to pipe-fitting combinations. In use, indenting units create first indentations (pushed-in areas) at the fitting’s outer surface; first excentuations (pushed-out areas) at the fitting’s inner surface; and second indentations (pushed-in area) at the pipe’s outer surface. These matched junctions interlock
pipe-fitting combinations into fixed, nonmovable arrangements. After a pipe-fitting combination is interlocked, the combination remains interlocked even after total separation of the indentation vise-wrench and the pipe-fitting combination. For comparison, after a routine vise-wrench fully-engages work, a user then typically manipulates the pair of handles as a unit to thereby effectively transmit force to such work. When an indentation vise-wrench fully-engages a positioned pipe-fitting combination, that action in aid of itself is valuable because such full-engagement creates interlocking junctions. In other words, after interlocking a pipe-fitting combination, a typical user of an indentation vise-wrench will then simply release/unlock the inventive hand tool from such combination because desired interlocking is achieved simultaneously with full-engagement.

[0035] Analysis Of Indenting Units. An indenting unit may include an upper end comprising an endpoint, a middle section between the indenting unit’s two ends, and a lower attaching-end. In use, indenting units’ endpoints impact with indenting pressure/force pipe-fitting combinations and thereby create interlocking junctions. An indented unit’s attaching-end joins the indenting unit to the jaw. Indenting units which are excessively high/tall can result in interlocks that are excessively tight; indenting units which are excessively low/short can result in ineffective interlocks. Indenting units’ compositions must comprise materials that are strong, hard, tough, and rigid; such units must be capable of creating interlocking indentations/exdentations; and such units must be at least as hard as, and preferably harder than, the hardness of both the pipe and the fitting which form the pipe-fitting combination. As an example, indentation units can be made of various steels (e.g., tool steels, high speed steels, high carbon steels, etc.). Each indenting unit has and terminates in an endpoint that impacts the fitting’s outer surface and then causes the desired interlocking. Endpoints can vary in size/shape; but endpoints must be capable of interlocking pipe-fitting combinations by creating interlocking junctions. Possible shapes include, among others, a circle, a point, a cross, a line segment, a pair of intersecting line segments (perpendicular or nonperpendicular), a pair of parallel line segments, a triangle, a square, a rectangle, an oval, etc. Indenting units must not and will not crush, cut, puncture, sever, or tear pipe-fitting combinations; rather, only interlocks will be created in combinations. In light of disclosures herein, any person skilled in the art can determine without undue experimentation all required aspects of indenting units, including without limitation selections regarding materials comprising indenting units; endpoints for indenting units; total number of indenting units; relative position of indenting units at jaws; dimensions/heights of indenting units; manners in which indenting units join jaws; etc.

[0036] Interlocking Environments. Indentation vise-wrenches are useful in many applications involving copper. In some typical situations, pipe-fitting combinations must be sealed. Interlocking those combinations prevents relative movement of the pipe and the fitting; thus, interlocked combinations then remain permanently ready for soldering. There are ample commercial sources for pipes and fittings suitable for use with the invention and such pipes and fittings are available in varying sizes (e.g., 1”, 3/4”, 1/2”, etc.). Copper pipes/fittings common in applications such as air-conditioning and refrigeration systems (ACR); drainage, waste, and venting systems (DWV); heating systems (e.g., hot-water baseboard, etc.); and plumbing systems (e.g., showers, toilets, drinking, appliance connections such as dishwashers or laundry machines, etc.) can be interlocked with various indentation vise-wrenches. Interlocking combinations can be obtained with both hard copper pipes (e.g., rigid pipes that are not bendable) and soft copper pipes (e.g., flexible pipes that are bendable), sometimes called copper tubing; interlocked pipe-fitting combinations (after suitable sealing) can safely contain both liquids such as water and gases such as refrigerant-type gases. Pipe-fitting combinations which are not suitable for interlocking are easily known; for example, excessively hard combinations (such as stainless steel pipes or black iron pipes) or excessively soft combinations (such as various plastic-based pipes). In light of disclosures herein, any person skilled in the art can determine without undue experimentation all required aspects of suitable pipe-fitting combinations for interlocking.

[0037] Overview Of Centering Units. In direct contrast to indenting units, centering units are optional. If no centering units are included, a user can still interlock pipe-fitting combinations. However, interlocking with off-center/out-of-position pipe-fitting combinations may create ineffective interlocks. Interlocking without centering units requires more careful manual positioning and is slower than interlocking with centering units.

[0038] Analysis Of Centering Units. All illustrated embodiments show an indentation vise-wrench with one centering unit comprising a screw connecting to the stationary handle. Other configurations are possible; in other embodiments (not shown), one centering unit connects to the stationary jaw or at least two centering units are included (e.g., a stationary jaw centering unit and a stationary handle centering unit; etc.). All illustrated embodiments show centering screws with a flat, round-shaped contacting-end; other embodiments (not shown) can use different configurations for the contacting-end (e.g., nonflat, nonround, curved, v-shaped, etc.) A centering unit may include an upper contacting-end, a middle section between the centering unit’s two ends, and a lower attaching-end. A centering unit’s contacting-end, in use, contacts a pipe-fitting combination and assists in proper positioning of that combination. A centering unit’s attaching-end joins the centering unit to the stationary jaw or stationary handle. This connection may be completely fixed so that the centering unit is operationally nonadjustable or it may permit the centering unit to be operationally adjustable (or even operationally removable). Overall, centering units’ dimensions and orientations must assist in proper positioning of pipe-fitting combinations; not interfere with opening/closing of jaws; and not interfere with interlocking. Proper positioning of pipe-fitting combinations relates to optimal impacting locations of indenting units with combinations. All illustrated embodiments show indentation vise-wrenches which create matched pinpoint-type interlocking junctions that are approximately 180° apart. In other embodiments (not shown), indentation vise-wrenches can be configured to create different patterns of interlocking junctions (e.g., three points each 120° apart; four points each 90° apart; two symmetrical pairs of points like a flattened “X”; etc.). The centering units’ compositions must comprise materials that are relatively firm; however, a level of firmness equivalent to that of indenting units is not required. As an example, centering units can be made from the same or similar metals used in the stationary jaws/handles. In light of disclosures herein, any person skilled in the art can deter-
mine without undue experimentation all required aspects of centering units, including without limitation selections regarding materials comprising centering units; contacting-ends for centering units; total number of centering units; relative position of centering units at stationary jaws/handles; dimensions/heights of centering units; manners in which centering units join stationary jaws/handles; etc.

[0039] Abutting Units. An abutting unit is at the stationary handle’s lower end; it has a upper contacting-end that meets the toggle link’s free-end within the stationary handle’s slot. Abutting units may be operationally adjustable/nonadjustable in relation to relative position.

[0040] Threaded Adjusting Screws. If an abutting unit comprises a threaded adjusting screw which is operationally adjustable, then both that screw itself and its adjusting abilities are generally the same as is known in the art (see 23/FIG. 1 and FIG. 4A). However, variations are possible (e.g., visible markings or a locking nut—see FIGS. 4B and 4C). Also, e.g., multiple threaded adjusting screws of different sizes are possible and each screw of a particular size can be removably inserted and then turned to set the position of its contacting-end for a pipe-fitting combination of a corresponding size (see FIG. 4D). If an abutting unit comprises a threaded adjusting screw which is operationally nonadjustable due to modification, then in this instance the threaded adjusting screw’s contacting-end is fixed. Possible modification techniques include brazing that screw to the stationary handle’s lower end. In FIGS. 2, 3, and 4, the inventive hand tool has a threaded adjusting screw in the form of a residual plug 50 with a fixed contacting-end 54 and covered by a nonadjustable/nonremovable outer housing cap 52. In light of disclosures herein, any person skilled in the art can determine without undue experimentation all required aspects of threaded adjusting screws, including without limitation selections regarding materials comprising threaded adjusting screws; contacting-ends for threaded adjusting screws; whether to be operationally adjustable/nonadjustable, etc.

[0041] Backing Units. A backing unit is a nonremovable/nonadjustable, simple, uncomplicated feature within the stationary handle’s slot. A backing unit comprises an inside wall (or a part projecting from the inside wall) at the stationary handle’s end; its upper contacting-end meets the toggle link’s free-end. If a backing unit appears then no threaded adjusting screws appears and vise-versa; backing units and threaded adjusting screws are used in lieu of the other. Backing units are not fixed residual threaded adjusting screws—those modified screws are still described as threaded adjusting screws. A backing unit is operationally nonadjustable/nonremovable in relation to relative position. None of the twenty drawings herein show an indentation vise-wrench having a backing unit in lieu of a threaded adjusting screw; however, the invention include those embodiments. Backing units’ compositions must comprise materials that are relatively firm; however, a level of firmness equivalent to that of indenting units is not required. As an example, backing units can be made from the same or similar metals used in the stationary jaws/handles. In light of disclosures herein, any person skilled in the art can determine without undue experimentation all required aspects of backing units, including without limitation selections regarding materials comprising backing units; contacting-ends for backing units; etc.

[0042] Single-Size/Multiple-Size. All illustrated embodiments relate to a single-size, nonadjustable indentation vise-wrench. In more detail, all illustrated embodiments relate to a single-size, nonadjustable inventive hand tool in which each jaw has one nonadjustable/nonremovable steel indenting unit joined to that jaw and projecting upward from the upper end of that jaw; one nonadjustable/nonremovable centering screw joins the stationary handle; and one nonadjustable/nonremovable threaded adjusting screw joins the stationary handle’s lower end. For example, with three single-size indentation vise-wrenches (1", 3/4", 1/2"), a user chooses the correct-sized inventive tool for each different individual combination to be interlocked. Other embodiments are possible in which a single indentation vise-wrench can interlock multiple pipe-fitting combinations of different sizes. As one example, a single indentation vise-wrench may have a removable centering screw and a removable threaded adjusting screw; the two removable screws together are a first pair of two screws sized for a pipe-fitting combination of a certain first size; and then—via replacement with a similar second pair sized for a pipe-fitting combination of a certain second size—that single indentation vise-wrench can interlock two different sizes of pipe-fitting combinations (see FIGS. 3A and 4B). As another example (not shown), if the pair of two indenting units is in the form of a pair of two removable screws with indenting units replacing the typical knurled-ends, then different pairs might interlock pipe-fitting combinations of different sizes.

[0043] Overview Of Illustrated Embodiments. Generally, FIGS. 1, 2, 3, and 4 each show full views of certain vise-wrenches. FIG. 1 shows a routine vise-wrench and FIGS. 2, 3, and 4 each show a particular embodiment of the inventive hand tool; many parts are common to routine/indentation vise-wrenches; however, all such common parts, individually or collectively, do not fairly disclose/suggest the present invention. FIG. 1 shows a routine vise-wrench without any work; FIG. 2 shows an indentation vise-wrench without any pipe-fitting combination; and FIGS. 3 and 4 show an indentation vise-wrench with a pipe-fitting combination. FIGS. 5A, 5B, and 6A show close-up views of interlocking. FIG. 6B shows a close-up view of soldering an interlocked combination. FIGS. 2A, 2B, 2C, 2D, 2E, 2F, 2G, 3A, 4A, 4B, 4C, and 4D show close-up views of structural elements of the indentation vise-wrench; FIGS. 2A, 2B, 2D, 2E, 2F, and 2G show indenting units; FIGS. 2C and 3A show centering units; FIGS. 4A, 4B, 4C, and 4D show threaded adjusting screws.

[0044] Analysis Of Particular Embodiments. FIG. 1 shows a complete routine vise-wrench 10; it lacks any indenting units or centering units; it has a stationary jaw 14a and a movable jaw 14b; each jaw has a gripping member 14c. The stationary jaw 14a is located at the upper end of the stationary handle 12 and the movable jaw 14b is located at the upper end of the movable handle 16. The stationary jaw/handle (14a/12) form a stationary arm; the movable jaw/handle (14b/16) form a movable arm. The stationary/movable handle (12/16) may have a soft covering (12a/16a). The torsion spring 20 biases the movable jaw 14b against the stationary handle 12 and a toggle link 22 against a contacting-end portion 24 of a threaded adjusting screw 23 contained within a slot 12c of the stationary handle 12. This torsion spring 20 has both an upper end 20a and a lower end 20b. The torsion spring’s upper end 20a attaches the torsion spring 20 to the movable jaw 14b at an opening 28 of the
movable jaw 14b. The torsion spring’s lower end 20b attaches to the torsion spring 20 to the stationary handle 12 at a raised stem 12b within a slot 12c of the stationary handle 12. A first pivot pin 18a connects the stationary handle 12 and the movable jaw 14b (the movable jaw 14b pivots on the stationary handle 12); a second pivot pin 18b connects the movable jaw 14b and the movable handle 16 (the movable handle 16 pivots on the movable jaw 14b); a third pivot pin 18c connects the movable handle 16 and a toggle link 22 (the movable handle 16 pivots on the toggle link); pivoting occurs cooperatively and simultaneously at each of the first pivot pin 18a, the second pivot pin 18b, and the third pivot pin 18c. A toggle link 22 has an upper pivot-end, a middle section with a notch, and a lower free-end. The toggle link’s free-end is slidably-moveable within the stationary handle’s slot; it meets the contacting-end 24 of the threaded adjusting screw 23. The routine vise-wrench 10 is fully-locked in which the second pivot pin 18b, the third pivot pin 18c, and the toggle link’s free-end form the dead center point line. A toggle release lever 16b is engaged with a fourth pivot pin 16c at the movable handle 16, pressing its lower actuating-end causes pivoting that makes its tipping-end push against the toggle link’s middle notch. In turn, this alters locking alignment (the third pivot pin 18c moves off the line) and the jaws/handles will spring open. A threaded adjusting screw 23 has an upper contacting-end 24 that meets the toggle link’s free-end within a slot 12c at the stationary handle 12; its threads 25 functionally engage an aperture at the stationary handle’s lower end; and its lower knurled-end 26 is outside the stationary handle’s lower end. Double headed arrows indicate movement; rotational movement of the lower knurled-end 26 causes corresponding lateral movement of the upper contacting-end 24. FIGS. 4A, 4B, 4C, and 4D each show close-up views of threaded adjusting screws for inclusion within alternative embodiments of indentation vise-wrenches (see later discussion). FIG. 2 shows a complete indentation vise-wrench 10; the primary (nonrelief view) shows jaws handles open; the supplementary (relief view) shows jaws handles closed; single-headed arrows show transition from open to closed; no pipe-fitting combination is shown. In FIG. 2, the indentation vise-wrench 10 has two indenting units 30, each on one of the two jaws. Of these two indenting units, the stationary indenting unit 30 projects upward from the stationary jaw 14a and the movable indenting unit 30 projects upward from the movable jaw 14b. The indenting units are the same, and accordingly, the stationary indenting unit and the movable indenting units are each labeled 30. Other embodiments (not shown) are possible in which the total number of indenting units; the allocation of the indenting units among the two jaws; the relative position of the indenting units at the jaws; the overall pattern of indenting units; nonsteel indenting units; etc. may differ from the illustrated embodiments. In FIGS. 2A and 2B, the indenting units’ dimensions are taken from a fully-made, fully-operational indentation vise-wrench having one indenting unit on each jaw; all such dimensions may differ in other embodiments (not shown). The endpoints of indenting units may be configured in many different shapes; the four drawings at FIGS. 2D-2G illustrate endpoints, respectively, that are circle-shaped, point-shaped, cross-shaped, line shaped. Also in FIG. 2, the indentation vise-wrench includes one centering unit 40 joining the stationary handle 12; the centering unit 40 comprises a screw. The centering unit’s lower attaching-end connects to the stationary handle 12. The centering unit’s middle region 42 is between the centering unit’s two ends. Although not illustrated in FIG. 2, this connection between the centering unit’s attaching-end and the stationary handle 12 may be in the form of a nut at the stationary handle 12; the centering unit 40 (centering screw), the nut, and the stationary handle 12 are simply brazed together to form a connection that is operationally nonadjustable and operationally nonremovable. In a different embodiment, the centering screw 40 is operationally adjustable via its attaching-end being functionally engaged with a nut 43 brazed onto the stationary handle (see FIG. 3A). Also, in the illustrated embodiment, the centering screw 40 has visible markings 41 corresponding to pipe-fitting combinations of different sizes (1", 3/4", 1/2")—this can be paired with a threaded adjusting screw 55 with similar visible markings corresponding to pipe-fitting combinations of different sizes (1", 3/4", 1/2") (see FIGS. 3A and 4B). The centering unit’s contacting-end 44 functions by assisting correct orientation when a pipe-fitting combination is placed between the stationary jaw 14a and the movable jaw 14b of the indentation vise-wrench. All embodiments illustrated in the drawings show one indenting unit at the upper region of each jaw; one centering unit connecting to the stationary handle 12; and relative positional arrangements of the two indenting units and the one centering unit such that interlocking is effected through matched pinpoint-type indentations/indentations that are approximately 180° apart. Other embodiments (not illustrated) are possible with different arrangements (e.g., instances in which only one interlocking junction is created or in which three or four equally or nonequally spaced matched interlocking junctions are created; etc.). In FIG. 2C, the indicated dimensions of the one centering screw are taken from a fully-made, fully-operationally indentation vise-wrench having one centering unit connecting to the stationary handle; all such dimensions may differ in other embodiments (not shown). FIG. 2 also illustrates (in relief and with arrows) relative movement of the movable jaw 14b towards the stationary jaw 14a (each jaw having one indenting unit 30 with a point-shaped endpoint 34). FIG. 3 shows a complete indentation vise-wrench 10 partially-engaging a pipe-fitting combination 38/36; the jaws/handles are open; the combination touches only the stationary indenting unit’s endpoint and the centering unit’s contacting-end 44. Consistent with partial-engagement, dead center point locking has not been established. FIG. 4 shows a complete indentation vise-wrench 10 fully-engaging a pipe-fitting combination 38/36; the jaws/handles are closed; the combination touches each indenting unit’s endpoint 34 and the centering unit’s contacting-end 44. Consistent with full-engagement, dead center point locking is established via the second pivot pin 18b, the third pivot pin 18c, and the toggle link’s free-end. FIGS. 4A, 4B, 4C, and 4D each show various embodiments of an abutting unit in the form of a threaded adjusting screw 55; each is an alternative embodiment to a threaded adjusting screw 50 that has been modified to be operationally nonadjustable, operationally nonremovable, and covered by an nonadjustable/ nonremovable outer housing cap 52; and each includes double-headed arrows to show possible rotational movement of its knurled-end and corresponding lateral movement of its contacting-end. In FIG. 4A, the threaded adjusting screw 55 is not modified in any way from a typical threaded adjusting screw 23/FIG. 1 of a routine vise-wrench 10/FIG.
1; in FIG. 4B, it has visible markings corresponding to pipe-fitting combinations of different sizes; in FIG. 4C, it includes a locking nut 56; in FIG. 4D, it exists as three screws of different sizes (1", 3/4", ½"). FIG. 5A shows close-up a pipe-fitting combination 38/36 touching the stationary indenting unit’s endpoint 34 and the centering unit’s flat, round-shaped contacting-end 44; it does not touch the movable indenting unit’s endpoint; it partially-engages the inventive hand tool. FIG. 5B shows close-up a pipe-fitting combination 38/36 touching each indenting unit’s endpoint and the centering unit’s flat, round-shaped contacting-end 44; it fully-engages the inventive hand tool. At this time of full-engagement, indenting pressure/force has created matched pinpoint-type indentations/indentations 35 that are approximately 180° apart. FIG. 6A shows close-up a pipe-fitting combination 38/36 at the moment when interlocking is being effected; no part of any centering unit shows. The overlap area is visible; in this overlap area a portion of the inner pipe 38 is snugly enclosed within a portion of the outer fitting 36; to the left of the overlap area is the pipe 38 (without the fitting); to the right of the overlap area is the fitting 36 (without the pipe). In other words, in the pipe-fitting combination 38/36, the pipe 38 moved from the left to the fitting 36 and the fitting 36 moved from the right to the pipe 38. FIG. 6B shows close-up, soldering being performed upon a previously interlocked pipe-fitting combination 38/36; the soldering involves a length of solder 46, a pipe-fitting area already soldered 47, a soldering torch 48, and soldering flame 49; all such soldering particulars are known in the art.

[0045] Related Products/Product. Certain related situations are also covered by the invention. For example, hand tool kits having a set of at least two indentation vise-wrenches; hand tool combination kits having a set of one or more indentation vise-wrenches together with at least one known soldering product; processes for making indentation vise-wrenches by modifying existing routine vise-wrenches to include indenting units or by assembling together individual component parts of routine vise-wrenches along with centering units; processes for interlocking positioned pipe-fitting combinations with indentation vise-wrenches; etc.

[0046] Alternative Embodiments. No illustrations are included herein with respect to certain alternative indentation vise-wrenches. Nonetheless, all alternative embodiments are within the scope of the invention. The embodiments of FIGS. 2, 2A, 2B, 3, 4, 5A, 5B, and 6A are for an indentation vise-wrench with two steel indenting units (one stationary indenting unit and one movable indenting unit), each the same as the other, each projecting upward from the upper end of a jaw; each with a point-shaped endpoint; other embodiments are possible with respect to indenting units (e.g., different total number, relative position at jaws; shape of endpoints, dimensions/heights, compositions, etc.). The embodiments of FIGS. 2, 3, 4, 5A, 5B, 6A are for an indentation vise-wrench with one centering unit comprising a screw with a flat, round-shaped contacting-end; the centering unit is operationally nonadjustable and operationally nonremovable and it connects to the stationary handle via a brazed nut; other embodiments are possible with respect to centering units (e.g., none included, different total number, not a screw, relative position at stationary jaws/handles, nonflat/nonround contacting-ends, operationally adjustable/removable, dimensions/heights, compositions, etc.). The embodiments of FIGS. 2, 3, and 4 are for an indentation vise-wrench with an abutting unit in the form of a threaded adjusting screw that has been modified to be operationally nonadjustable and operationally nonremovable; it has a housing cap covering it outside the stationary handle’s lower end; other embodiments are possible with respect to the abutting unit (e.g., an unmodified threaded adjusting screw, a backing unit in lieu of a threaded adjusting screw, etc.).

[0047] Making Indentation Vise-Wrenches. The following explains how to make a single-size indentation vise-wrench. First, obtain the following starting materials—a routine vise-wrench (e.g., IRWIN® Model 10WR® ProTouch™ VISE-GRIP®); two Phillips-type insert drill bit tips (e.g., DEWALT® Phillips #2 1-Inch Insert Drill Bit); a standard screw having threads and a hexagonal head (e.g., a screw dimensioned as length: 1", width: ½", threads/inch: 20) and a standard nut for that screw; a locking nut sized for the threaded adjusting screw; and standard tools that can grind, cut, flatten, and braze). Second, two identical steel indenting units can be made as follows. Grind a bit tip with a standard benchtop grinder to transform the Phillips-part into a sharp point-shaped endpoint. Cut the sharpened bit tip with a benchtop grinder or with a portable spinning/cutting hand tool (e.g., a hand tool from DREMEL®) to an acceptable height. Flatten the end of the cut sharpened bit tip with a benchtop grinder or hand tool. Grind an upper part of each jaw with a benchtop grinder to form a flattened area at each jaw. For each bit tip, join the bit tip to a jaw by brazing together the cut, flattened area of the bit tip with the flattened area of the jaw. Third, a centering screw can be made as follows. Grind the screw’s hexagonal head with a benchtop grinder or hand tool to make it flat and round-shaped. If necessary, grind/flatten an area on the stationary handle which will join with the centering screw. Position a nut on the stationary handle and insert into that nut the centering screw now having a flat, round-shaped contacting-end. Brazed together the centering screw, the nut, and the stationary handle. Fourth, the threaded adjusting screw can be prepared as follows. Completely remove it from the stationary handle’s lower end. Reinsert it through the locking nut and into the stationary handle’s lower end. Secure the locking nut against the external side of the stationary handle’s lower end. The single-size indentation vise-wrench would then be finished.

[0048] Enablement. In light of the disclosures herein, a person skilled in the art can make/use all embodiments, illustrated or not shown, of the invention.

[0049] No Implied Admissions. Applicant intends all discussions herein to satisfy applicable patent standards and intends that no implied admissions are created. Accordingly, subject to applicable patent standards, Applicant affirmatively and expressly limits all disclosures herein in a manner which does not create any implied admissions. For example and without limitation, Applicant does not admit that the arts for crimping, cutting, or puncturing, individually or collectively; are analogous to each other; nor to arts for routine vise-wrenches; nor to arts for gripping-type operations being effected with routine vise-wrenches. Also, Applicant does not admit that the art for routine vise-wrenches is analogous to arts for other hand tools (e.g., art for one-handle tools, art for tools without two jaws; art for tools lacking locking mechanisms; etc.).

[0050] Nonexhaustive Disclosures. No disclosure herein is exhaustive, nor is it intended to be exhaustive, whether
with regard to discussions of routine vise-wrenches; of particular patent documents, of the overall invention; of particular component parts of the invention; etc. In each instance, although further analysis/elaboration is or may be possible, the discussion is intended to satisfy applicable patent standards. Accordingly, Applicant affirmatively and expressly reserves the right, subject to applicable patent standards, to introduce further analysis/elaboration in relation to any disclosure.

[0051] Scope Of The Invention. As an aid in understanding the invention, numerous details are reviewed above; sometimes in connection with various aspects of the drawings which are provided herein for nonlimiting, representative, exemplary purposes only and sometimes in connection with other issues. Notwithstanding details relating to advantages, attributes, components, diagrams, embodiments, examples, explanations, features, purposes, or uses disclosed herein for the invention (collectively, “specific disclosures”), the invention is defined solely by the following claims’ scope (to the fullest possible extent consistent with the spirit and letter thereof). Thus, pursuant to the claims, the invention is not confined, limited, or otherwise restricted to specific disclosures; rather, it encompasses specific disclosures together with alterations, modifications, and variations thereof which are available without undue experimentation to those skilled in the art.

1 claim:
1. An indentation vise-wrench.
2. An indentation vise-wrench comprising:
   operatively interconnected structural elements comprising a stationary jaw, a stationary handle, a movable jaw, a movable handle, a toggle link, a toggle release lever, an abutting unit comprising a threaded adjusting screw or a backing unit, and an indenting unit at a jaw;
   subject to the following provisions—
   a centering unit is or is not included; and
   the indentation vise-wrench can interlock pipe-fitting combinations by creating matched indentations/indentations.
3. The indentation vise-wrench of claim 2 wherein:
   each jaw has one steel indenting unit.
4. The indentation vise-wrench of claim 3 wherein:
   the two steel indenting units have the same relative compositions and dimensions; and
   each steel indenting unit projects upward from the upper end of each jaw.
5. The indentation vise-wrench of claim 2 wherein:
   no centering units are included.
6. The indentation vise-wrench of claim 5 wherein:
   each jaw has one steel indenting unit;
   the two steel indenting units have the same relative compositions and dimensions; and
   each steel indenting unit projects upward from the upper end of each jaw.
7. The indentation vise-wrench of claim 2 wherein:
   one centering unit is included;
   the one centering unit connects to the stationary handle; and
   the one centering unit comprises one centering screw.
8. The indentation vise-wrench of claim 7 wherein:
   each jaw has one steel indenting unit;
   the two steel indenting units have the same relative compositions and dimensions; and
   each steel indenting unit projects upward from the upper end of each jaw.
9. The indentation vise-wrench of claim 7 wherein:
   each of the one centering screw and the abutting unit is operationally nonadjustable and operationally nonremovable.
10. The indentation vise-wrench of claim 7 wherein:
    the abutting unit comprises a threaded adjusting screw;
    and
    each of the one centering screw and the threaded adjusting screw is operationally adjustable and operationally removable.
11. The indentation vise-wrench of claim 10 wherein:
    the one centering screw and the threaded adjusting screw together are a first pair of two screws sized for a pipe-fitting combination of a first size;
    subject to the following provision—
    the first pair of two screws can be replaced with a similar second pair of screws sized for a pipe-fitting combination of a second size.
12. The indentation vise-wrench of claim 2 wherein:
    the abutting unit comprises a backing unit;
    the backing unit is other than a threaded adjusting screw;
    the backing unit is operationally nonadjustable and operationally nonremovable;
    the backing unit has a contacting-end that meets the toggle link’s free-end; and
    the backing unit comprises an inner wall at the end of the stationary handle or a platform-type portion at an inner wall at the end of the stationary handle.
13. The indentation vise-wrench of claim 12 wherein:
    the backing unit comprises an inner wall at the end of the stationary handle.
14. The indentation vise-wrench of claim 12 wherein:
    the backing unit comprises a platform-type portion at an inner wall at the end of the stationary handle.
15. The indentation vise-wrench of claim 12 wherein:
    each jaw has one steel indenting unit;
    the two steel indenting units have the same relative compositions and dimensions; and
    each steel indenting unit projects upward from the upper end of each jaw.
16. The indentation vise-wrench of claim 12 wherein:
    no centering units are included.
17. The indentation vise-wrench of claim 16 wherein:
    each jaw has one steel indenting unit;
the two steel indenting units have the same relative compositions and dimensions; and

each steel indenting unit projects upward from the upper end of each jaw.

18. The indentation vise-wrench of claim 12 wherein:

one centering unit is included;

the one centering unit connects to the stationary handle; and

the one centering unit comprises one centering screw.

19. The indentation vise-wrench of claim 18 wherein:

each jaw has one steel indenting unit;

the two steel indenting units have the same relative compositions and dimensions; and

each steel indenting unit projects upward from the upper end of each jaw.

20. An indentation vise-wrench (10/FIG. 2) comprising:

two jaws, one a stationary jaw (14a), one a movable jaw (14b);

two handles, one a stationary handle (12), one a movable handle (16);

the stationary jaw/handle (14a/12) forming a stationary arm, the movable jaw/handle (14b/16) forming a movable arm;

a first pivot pin (18a) on the stationary jaw (14a), a second pivot pin (18b) on the movable jaw (14b), a third pivot pin (18c) on the movable handle (16), a fourth pivot pin (16c) on the movable handle (16);

the movable jaw (14b) engaging the first pivot pin (18a);

two steel indenting units, one a stationary steel indenting unit (30) with a point-shaped endpoint (34) projecting upward from the upper end of the stationary jaw (14a), one a movable steel indenting unit (30) with a point-shaped endpoint (34) projecting upward from the upper end of the movable jaw (14b), the two steel indenting units having the same relative compositions and dimensions;

a centering screw (40) having a flat, round-shaped upper contacting-end (44) capable of positioning a pipe-fitting combination (38/36), a middle section (42), a lower attaching-end joining the stationary handle at a nut (43/FIG. 3A);

a torsion spring (20) having an upper end (20a) connecting to an opening (28) in the movable jaw (14b) and a lower end (20b) connecting to raised stem (12b) at a slot (12c) in the stationary handle (12);

a toggle link (22) having an upper pivot-end engaging with the second pivot pin (18b), a middle section with a notch, a lower free-end at a slot (12c) in the stationary handle (12);

a threaded adjusting screw (55/FIG. 4C) having an upper contacting-end at a slot (12c) in the stationary handle (12), a middle section with threads engaging a locking nut (56/FIG. 4C) at an aperture at the stationary handle’s lower end, a lower knurled-end outside the stationary handle’s lower end;

subject to the following provisions—

the indentation vise-wrench (10/FIG. 2) can transition between positions of jaws/handles open (FIG. 3) and jaws/handles closed (FIG. 4) and pivoting occurs cooperatively and simultaneously at each of the first pivot pin (18a), the second pivot pin (18b), and the third pivot pin (18c) during any transition;

the indentation vise-wrench (10/FIG. 4) can fully-engage a pipe-fitting combination (38/36) with the two indenting units;

at full-engagement, each of the second pivot pin (18b), the third pivot pin (18c), and the toggle link’s free-end have dead center point alignment (FIG. 4A) and the two indenting units create two pinpoint-type matched indentations (of the outer fitting’s inner surface) and indentations (of the inner pipe’s outer surface) that are approximately 180° apart (35/FIG. 6A);

after full-engagement and through the action of the toggle release lever, the indentation vise-wrench can be released to have jaws/handles open and to have the pipe/fitting combination and the indentation vise-wrench totally separate; and

after total separation, the pipe-fitting combination (38/36) remains interlocked into a fixed arrangement in which neither the inner pipe nor the outer fitting can move with respect to each other because of interlocking junctions (35/FIG. 6A).