Feb. 24, 1953 W. E. MILLIGAN 2,629,280

ADJUSTABLE OUTER JAW PIPE WRENCH OF THE PIVOTED HOUSING TYPE

Filed April 11, 1950

3 Sheets-Sheet 1

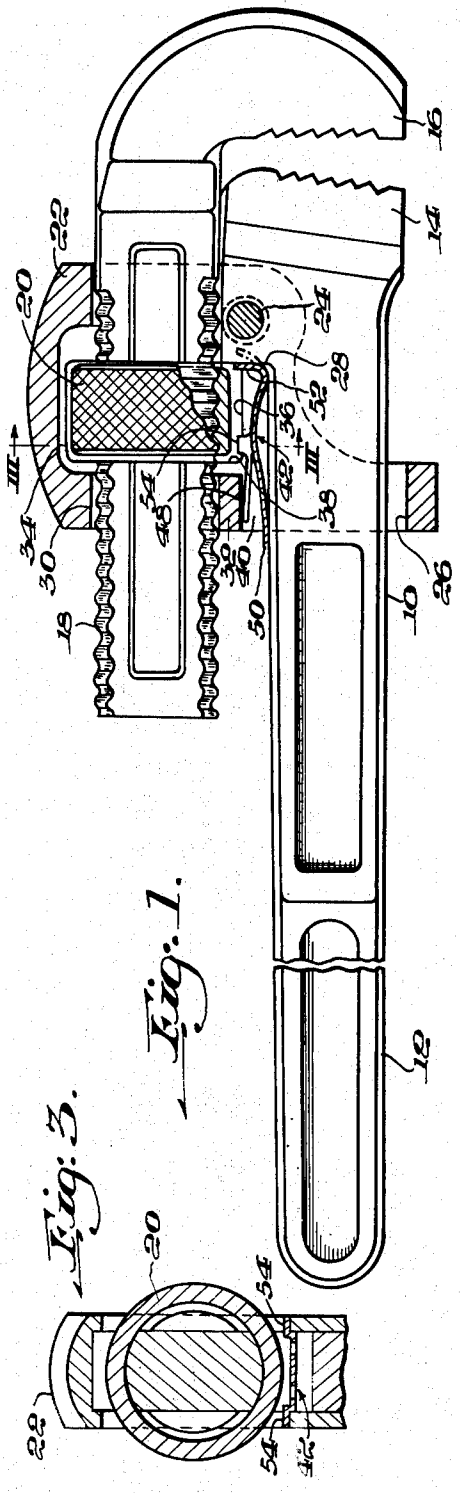

Fig. 1.

Fig. 3.

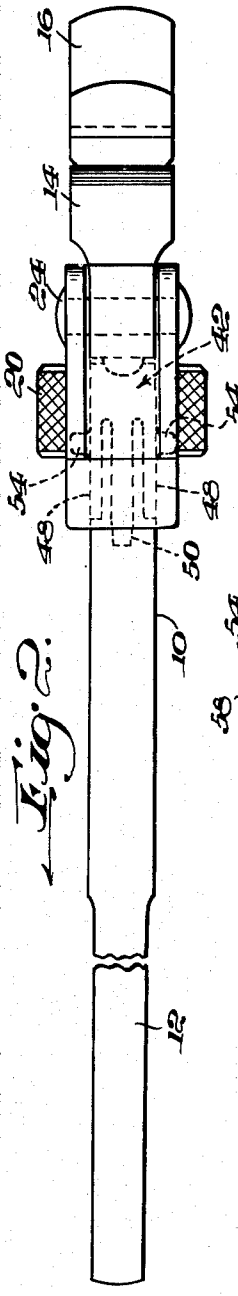

Fig. 2.

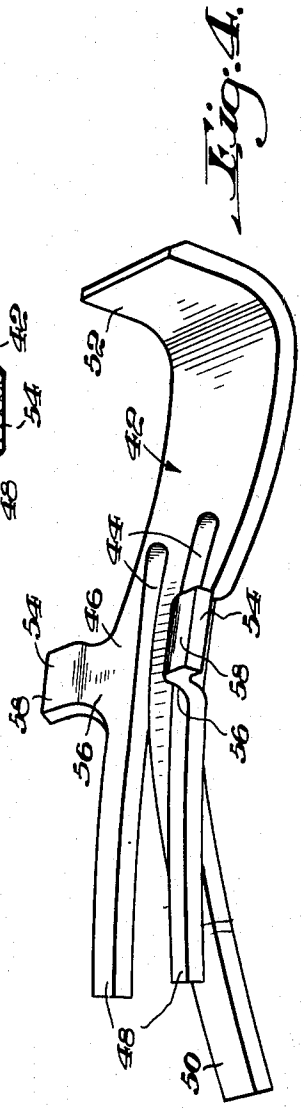

Fig. 4.

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Filed April 11, 1950 3 Sheets-Sheet 2

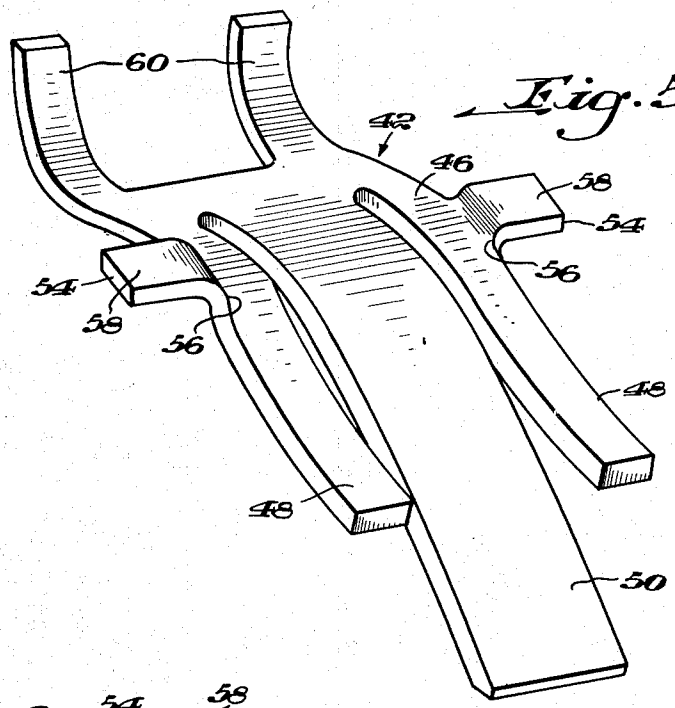

Fig. 5.

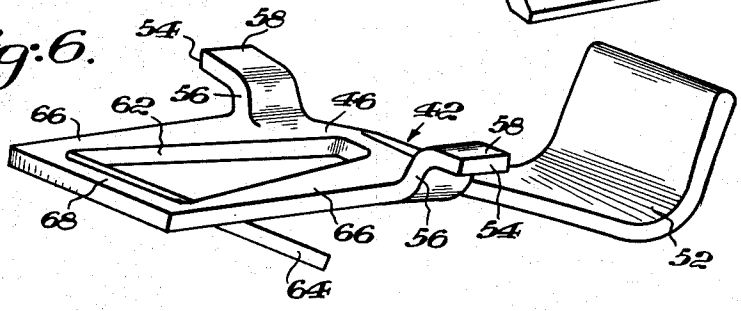

Fig. 6.

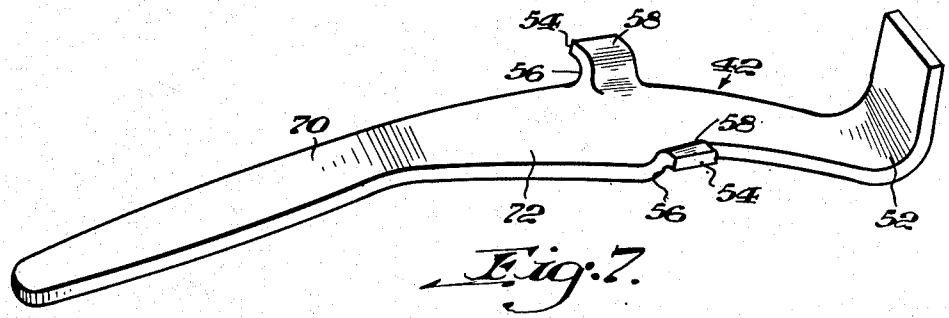

Fig. 7.

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ADJUSTABLE OUTER JAW PIPE WRENCH OF THE PIVOTED HOUSING TYPE

Filed April 11, 1950 3 Sheets-Sheet 3

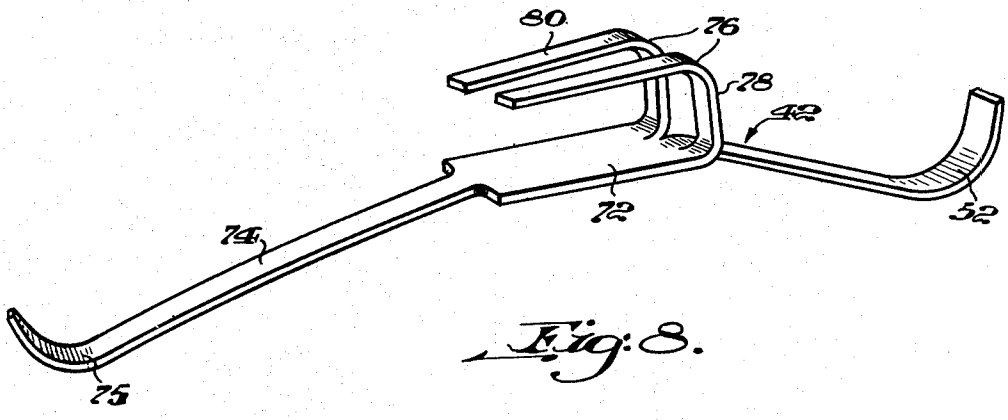

Fig. 8.

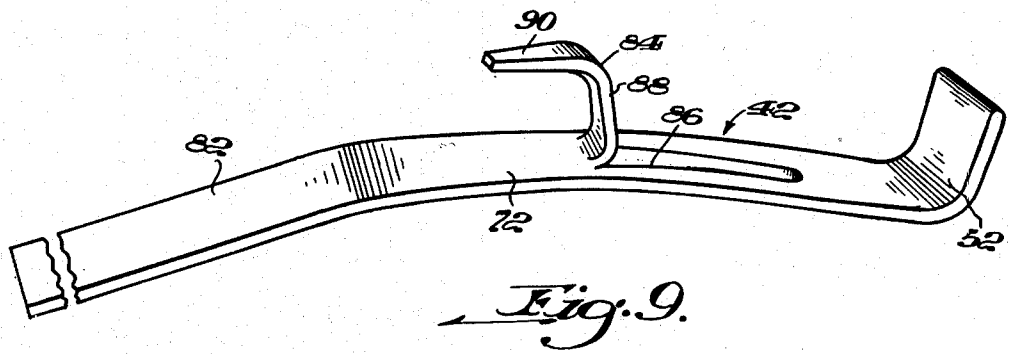

Fig. 9.

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UNITED STATES PATENT OFFICE

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ADJUSTABLE OUTER JAW PIPE WRENCH OF THE PIVOTED HOUSING TYPE

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Application April 11, 1950, Serial No. 155,324

15 Claims. (Cl. 81—105)

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This invention relates to pipe wrenches and more particularly to those having an adjustable traveling outer jaw carried in a housing or frame which is pivotally mounted on the bar or handle portion.

The pivoted housing type pipe wrench is shown and described in Patent No. 126,161 dated April 30, 1872, to Daniel C. Stillson. This patent discloses a pair of leaf springs which cooperate with the pivoted housing for controlling the action of the adjustable outer jaw in a well-known manner. Pipe wrenches according to this original design are still being manufactured and sold in large quantities despite numerous attempts over the years to improve upon it. The spring action has been the subject of particular attention since it ensures a positive pipe gripping action together with positive release to permit the familiar ratchet movement.

The spring means is generally designed as in the aforesaid patent to hold the pivoted housing in a neutral position with the possibility of rotation of the movable jaw in either direction relative to the bar or handle. The use of two separate springs opposing each other is a common expedient but introduces the problem of adjusting the spring resistance on individual wrenches in view of normal variations in large scale manufacturing operations. Leaf springs require attachment to the bar or frame by riveting or other special operation which involves additional manufacturing expense and tends to weaken the parts. Coil springs are necessarily loosely mounted and subject to loss. Both types of spring are subject to breakage in use as they are generally exposed to damage. Under these conditions wrenches are discarded in the field as replacement of the springs is impractical.

The present invention provides a spring element positioned in the pivoted housing between the bar portion of the wrench and the shank of the movable jaw. The spring element is a generally rectangular sheet of thin flexible material having a curvature between opposite ends. The spring element has an angular end portion and a retainer section at the median portion operatively engaging a heel on the bar and a portion of the housing respectively for placing a portion of the spring element therebetween under compression. The opposite end of the spring element extends into operative engagement with the bar and acts as a cantilever. Various modified forms of the spring element are disclosed having the same general principles of spring action to provide for return of the housing and movable

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jaw to neutral position after pivotal movement to connect the spring element to the housing and transfer motion thereto and to provide back action or bite to the movable jaw during normal ratcheting in use.

Another object of the invention is to secure the utmost ease in action of the pivoted housing.

Another object of the invention is to regulate the force of the spring element to any desired amount.

Another object of the invention is to regulate the relationship between forward and backward action to any ratio.

Another object of the invention is to reduce wear of parts in contact with each other and to eliminate any sliding of spring sections one upon the other.

Another object of the invention is to avoid interference by the spring element with full travel of the housing and the movable jaw.

Another object of the invention is to distribute the normal stress throughout the spring element.

Another object of the invention is to retain the spring element securely in position and protect it against damage during use of the wrench.

Another object of the invention is to eliminate machining operations and thus reduce the cost of production.

Another object of the invention is to facilitate assembly of the parts with the spring element in corrrect position without the use of tools.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a side elevation partly in section of a pipe wrench embodying the invention,

Fig. 2 is a bottom plan view of the pipe wrench shown in Fig. 1,

Fig. 3 is a partial cross-section taken on the line III—III of Fig. 1,

Fig. 4 is a perspective view of the spring element separated from the pipe wrench,

Figs. 5 to 9 inclusive are perspective views of modified forms of spring elements.

Referring more particularly to the drawings, the pipe wrench of this invention follows generally the form of that disclosed in the aforesaid Stillson patent and includes a bar 10 having a handle portion 12 and a relatively stationary jaw portion 14 thereon. A movable jaw 16 is cooperable with the stationary jaw 14 and is provided with a threaded shank 18 having the usual adjusting nut 20 positioned thereon.

A hollow housing 22 is provided for the shank

18 and is pivotally mounted on a rivet or pin 24 on the bar 10 adjacent the stationary jaw 14. The bar 10 extends through a lower opening 26 (as viewed in Fig. 1) in the housing 22 and is provided with a heel 28 positioned within the housing 22. The shank 18 of the movable jaw 16 extends through an upper opening 30 formed in the housing 22 and separated from the lower opening 26 at the rear portion of the housing 22 by a brige 32.

The side walls of the housing 22 on either side of the shank 18 are provided with oppositely disposed openings forming a window 34 in which the adjusting nut 20 is positioned. As shown in Fig. 1, the adjusting nut 20 is normally spaced from the lower walls 36 of the window 34. Likewise, the bridge 32 is set back somewhat from the adjacent wall 38 of the window 34. Furthermore, the bridge 32 and the bar 10 are normally separated by a space, designated 40, to provide for free pivotal movement of the housing 22 and the movable jaw 16 relative to the stationary jaw 14.

As previously indicated, this invention is more particularly directed toward improvement in the spring action of the wrench. To this end, a novel spring element 42 is provided and is shown more clearly in one embodiment in Fig. 4. As will be apparent, this element 42 comprises a generally rectangular sheet of thin flexible material provided with a pair of open-ended slots 44 extending lengthwise thereof and terminating adjacent a median portion 46 of the spring element 42. As thus constructed, the slots 44 are spaced one from the other leaving two side strip portions 48 and one middle strip portion 50 connected at the median portion 46. The middle strip portion 50 forms a first bowed spring arm section having a curvature in one direction from the plane of the median portion 46. The side strip portions 48 form a pair of second bowed spring arm sections having a curvature in the opposite direction from the plane of the median portion 46.

The opposite end 52 of the spring element 42 is of angular form having normally a curvature tangential with the median portion 46. Viewed as a unit therefore, the spring element 42 has a curvature extending from end to end and terminates in the angular end portion 52 which extends substantially normal to the plane of the spring element 42. As will hereinafter be apparent, the angular portion 52 is movable from its tangential relation shown in Fig. 4 to the position shown in full lines in Fig. 1.

The spring element 42 is provided with a pair of retaining fingers 54 which project from opposite sides of the median portion 46. The retaining fingers 54 are of angular form having connecting portions 56 extending substantially normal to the plane of the median portion 46 and having outer portions 58 extending substantially parallel with said plane.

The spring element 42 is inserted in the housing 22 in the location shown in Fig. 1 with the side and middle strip portions 48, 50 projecting into the space 40. Such insertion may be easily accomplished without tools by pressing down upon the middle strip portion 50 until the retaining fingers 54 engage the bottom wall of the window 36 adjacent the side wall 38 thereof. The housing 22 is then rotated clockwise about its pivot 24 until the angular end portion 52 of the spring element 42 engages the heel 28 of the bar 10.

Since the angular end portion 52 moves from the tangential position shown in broken lines in Fig. 1 to the full line position during the foregoing assembly operation, then the angular end portion 52 of the spring element 42 is placed under compression. This stress is relied upon for holding the spring element 42 in position in the housing 22.

The remainder of the spring element 42 functions as a two-leaf cantilever. That is, the load on the housing 22 is applied by the bridge 32 to the spring element 42 through the middle strip portion 50. This load is absorbed through the side strip portions 48 on the interior of the housing 22 while the reaction at the bar 10 is absorbed by the middle strip portion 50. The combination of these two deflections produces a strong backward action on the housing 22 and movable jaw 16 when the wrench is ratcheted forward in use. This feature is supplemental to the element of the spring action which provides for forward motion or which brings the movable jaw 16 back into line after it has overhung the stationary jaw 14. This action is due to the angular end portion 52 which operates against the heel 28 of the bar 10 and which as previously explained is normally under stress.

It will further be observed that the spring element 42 maintains the desired neutral position of the housing 22 and movable jaw 16 due to the spring sections being in equal tension while the wrench is in unoperated condition. Since the spring element 42 is of a unitary nature there can be no variation between the elements which provide a forward action and those which provide a backward action. Moreover, since the spring element 42 is housed below the window 34 and within the space 40 between the bridge 32 and the bar 10, there is no interference with the full travel of the housing 22 or the movable jaw 16 carried thereby. The spring element 42 does not become compressed or flattened out during use since it does not undergo any crushing action.

In the modified form of spring element 42 shown in Fig. 5, the angular portion is bifurcated to form two arms 60 having movement independently of each other. Otherwise, this modified form is identical with that shown in Fig. 4.

In the modified form shown in Fig. 6, a similar generally rectangular sheet of thin flexible material, as in the embodiment of Figs. 4 and 5, is provided for the spring element 42. However in this modified form the cantilever end of the spring is different from the previously described forms although the spring action remains essentially the same. Thus, the spring element 42 in Fig. 6 is provided with an elongated aperture 62 having a tongue 64 projecting from the wall thereof farthest from the median portion 46 of the spring element 42. The tongue 64 forms a bowed spring arm section projecting from the plane of the median portion for engagement with the bar 10 at a point within the housing 22 substantially opposite the window 34. The angular end portion 52 is retained in this embodiment and the tongue 64 extends substantially parallel thereto. The side wall portions 66 on either side of the aperture 62 form a pair of neutral spring portions having a connected end 68 remote from the median portion 46 and being adapted to operatively engage the bridge 32 when the spring element 42 is positioned in the housing 22.

In Fig. 7 the cantilever end of the spring ele-

ment 42 is also modified from that shown in the preceding forms. In this embodiment, the cantilever comprises a single spring arm 70 comparable to the middle strip portion 50 of the Figs. 4 and 5 embodiments. The spring arm 70 is provided with a curvature for operative engagement with the bar 10 when the spring element 42 is in position in the housing 22. There is, however, a neutral portion 72 between the median portion 46 and the spring arm 70 which serves to transmit forces between the spring element 42 and the bridge 32 of the housing 22. In other respects, including the angular portion 52 and the retaining fingers 58, the spring shown in the embodiment of Fig. 7 is similar to that of the preceding forms.

In the embodiments of Figs. 8 and 9, the spring element 42 follows generally the form of that described in connection with Fig. 7. The cantilever portion comprises a single spring arm 74 which is reduced in width from the neutral portion 72 and provided with an angular end 75 for operative engagement with the bar 10. Thus, the arm 74 constitutes a first bowed spring arm section projecting in one direction from the neutral portion 72 while the angular end 52 forms a second bowed spring arm section projecting in the opposite direction from the neutral portion 72. As in the preceding embodiments, the angular end portion 52 has a curvature tangential to the spring arm section of which it forms a part. A pair of retaining finger sections 76 project from the neutral portion 72 and are bent into spaced overlying relation. Thus, the retaining fingers have connecting portions 78 extending substantially normal to the plane of the neutral portion 72 and also have outer portions 80 extending substantially parallel to said plane. When the spring element 42 of the Fig. 8 embodiment is positioned in the housing 22, the retaining fingers 78 overlie the bridge 32 and cooperate with the angular portion 52 which operatively engages the heel 28 for compressing the angular end portion 52 of the spring element 42 therebetween.

The embodiment shown in Fig. 9 differs from that shown in Fig. 8 only insofar as the cantilever spring arm section 82 is not reduced in width from the neutral portion 72 and no angular end portion is formed thereon. Moreover, a single retaining finger 84 is provided by forming an elongated aperture 86 in the neutral portion and utilizing one wall of the aperture 86 to form a tongue projecting from the neutral portion 72. The retaining finger 84 has a connecting portion 88 extending substantially normal to the plane of the neutral portion 72 and also an outer portion 90 extending substantially parallel to said plane. It will be apparent that in both embodiments, Figs. 8 and 9, the neutral portion 72 serves to transmit forces between the spring element 42 and the bridge 32 as in the case of the embodiment shown in Fig. 7.

While various forms of cantilever spring action have been described and shown in conjunction with adjustable outer jaw wrenches of the pivoted housing type it will be apparent that various changes may be made in the details of construction and arrangement of parts without departing from the invention as defined in the appended claims.

I claim:

1. A pipe wrench comprising a bar having a handle portion and a relatively stationary jaw portion thereon, a movable jaw having a threaded shank, a hollow housing for said shank pivotally mounted on said bar adjacent said stationary jaw portion and having oppositely disposed windows in side walls thereof, said side walls being connected on one side of said windows by a bridge normally spaced from said bar, said bar having a heel projecting between said side walls on the opposite side of said windows, an adjusting nut on said shank and positioned within said housing between said windows, and a spring element positioned in said housing between the bar and said shank for normally maintaining said housing in a neutral position relative to said bar, said spring element having one end and a median portion thereof operatively engaging said heel and said one side of said windows respectively for placing a portion of said spring element there-between under compression, said spring element extending beyond said median portion and into said space for operative engagement with said bar.

2. A pipe wrench as claimed in claim 1 wherein said one end of said spring element is of angular form for engaging said heel and is movable under compression for retaining said spring element in operative position.

3. A pipe wrench as claimed in claim 2 wherein said compressed portion of said spring element is curved longitudinally of said bar thus forming a cantilever having a free end providing said operative engagement with said bar.

4. A pipe wrench comprising a bar having a handle portion and a relatively stationary jaw portion thereon, a movable jaw having a threaded shank, a hollow housing for said shank pivotally mounted on said bar adjacent said stationary jaw portion and having oppositely disposed windows in side walls thereof, said side walls being connected on one side of said windows by a bridge normally spaced from said bar, said bar having a heel projecting between said side walls on the opposite side of said windows, an adjusting nut on said shank and positioned within said housing between said windows, and a spring element positioned in said housing between the bar and said shank for normally maintaining said housing in a neutral position relative to said bar, said spring element having an angular end portion and retaining fingers extending transversely from the median portion thereof for operative engagement with said heel and said one side of said windows respectively, said angular end portion being movable under compression for retaining said spring element in operative position, said spring element having a pair of elongated openings extending from an end opposite said angular end and toward said median portion and defining side and middle strip portions bowed in opposite directions respectively for operative engagement with said bar and said bridge respectively.

5. A spring element for pipe wrenches and the like comprising a sheet of flexible material having a curvature between the opposite ends thereof which lie in substantially the same plane, one of said ends terminating in a portion having angular relation to said plane and being adapted for movement relative to said sheet, a retainer section formed in said curvature and including a retaining finger section having an outer portion substantially parallel with said plane, said retainer section defining with said angular end a bowed retaining portion on said sheet adapted to be placed in compression upon said relative movement of said angular end, the portion of said sheet

extending from said retainer section to the end opposite said angular end forming a bowed spring arm section adapted for cantilever action.

6. A spring element as claimed in claim 5 wherein said sheet is generally rectangular and provided with a pair of elongated openings in one end terminating adjacent said retainer section and defining side and middle strip portions bowed in opposite directions respectively.

7. A spring element as claimed in claim 6 wherein said openings comprise a pair of open ended slots extending lengthwise of said sheet and being spaced one from the other leaving two side and one middle strip portions connected at said retainer section, said middle strip portion forming a first bowed spring arm section having a curvature in one direction from the plane of said retainer section, said side strip portions forming a pair of second bowed spring arm sections having a curvature in the opposite direction from the plane of said retainer section, said angular end having normally a curvature tangential with said retainer section, said finger section including a pair of oppositely disposed fingers having connecting portions extending substantially normal to said plane and outer portions extending substantially parallel with said plane.

8. A spring element as claimed in claim 7 wherein said angular end is of bifurcated form.

9. A spring element as claimed in claim 5 wherein said sheet is provided with an elongated aperture having a tongue depending from one wall thereof and spaced from the side wall portions, said tongue forming a bowed spring arm section projecting from said plane, said side wall portions forming a pair of neutral portions having a connected end remote from said retainer section, said angular end having normally a curvature tangential with said retainer portion, said finger section including a pair of oppositely disposed fingers having connecting portions extending substantially normal to said plane and having outer portions extending substantially parallel with said plane.

10. A spring element as defined in claim 9 wherein said tongue depends from the wall of said aperture opposite said connected end and substantially parallel with said angular portion.

11. A spring element as claimed in claim 5 wherein said retainer section includes a neutral portion, said bowed spring arm section projecting from said neutral portion, said angular end projecting from said neutral portion opposite said spring arm section and having normally a curvature tangential with said retainer section, said flinger section including a pair of oppositely disposed fingers projecting from said neutral portion and having connection portions extending substantially normal to said plane and having outer portions extending substantially parallel with said plane.

12. A spring element as claimed in claim 5 wherein said retainer section includes a neutral portion, said bowed spring arm section projecting in one direction from said neutral portion, a second bowed spring arm section projecting in an opposite direction from said neutral portion, said angular end portion being formed on said second spring arm section and normally having a curvature tangential thereto, said finger section projecting from said neutral portion and being bent into spaced overlying relation thereto.

13. A spring element as claimed in claim 12 wherein said retaining finger section has connecting portions extending substantially normal to said plane and has outer portions extending substantially parallel to said plane.

14. A spring element as claimed in claim 13 wherein said retaining finger section is of bifurcated form.

15. A spring element as claimed in claim 13 wherein said neutral portion is provided with an elongated aperture, said retaining finger section being formed as a tongue projecting from the wall of said aperture adjacent said neutral portion.

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