Feb. 24, 1953

N. O. SMITH-PETERSEN ET AL

2,629,279

ADJUSTABLE OUTER JAW PIPE WRENCH OF THE FIXED HOUSING TYPE

Filed Aug. 31, 1948

2 SHEETS—SHEET 1

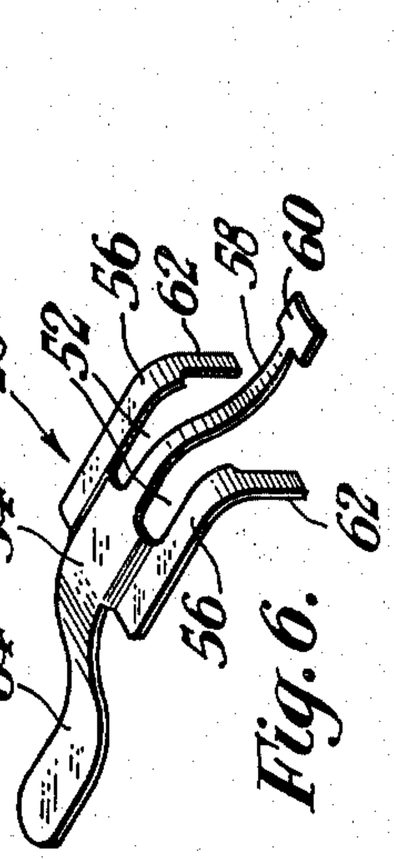

Fig. 6.

Fig. 1.

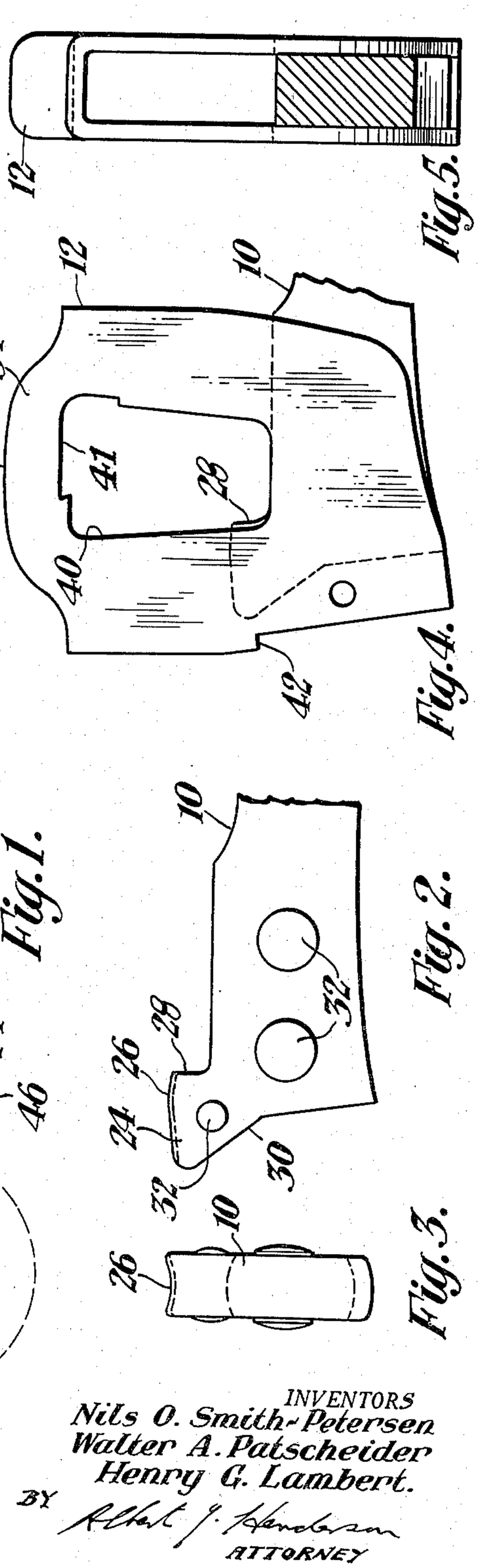

Fig. 4.

Fig. 5.

Fig. 2.

Fig. 3.

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2 SHEETS—SHEET 2

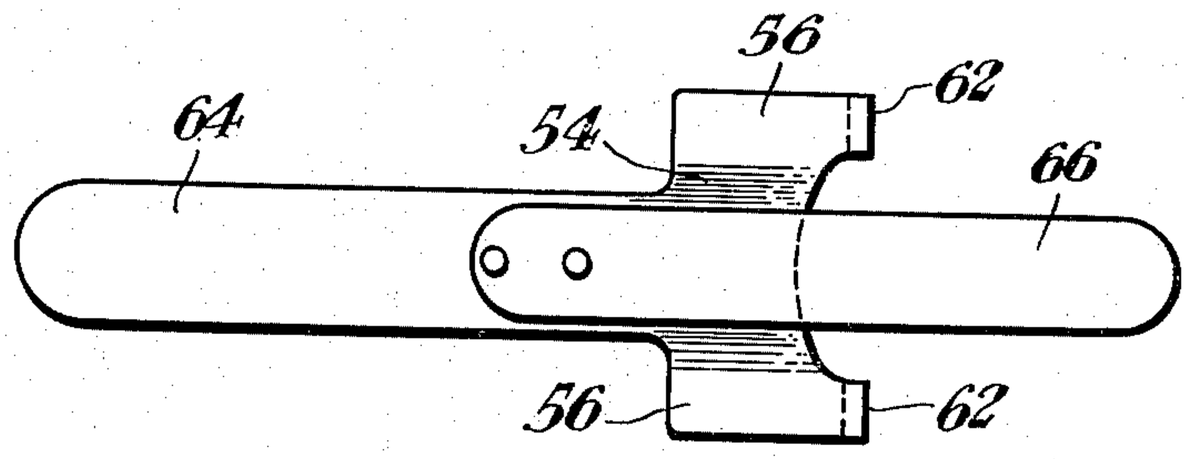

Fig. 7.

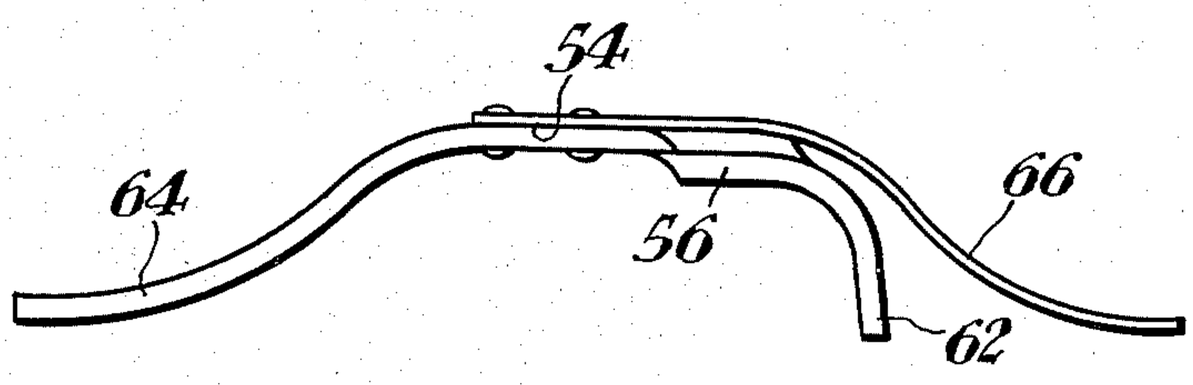

Fig. 8.

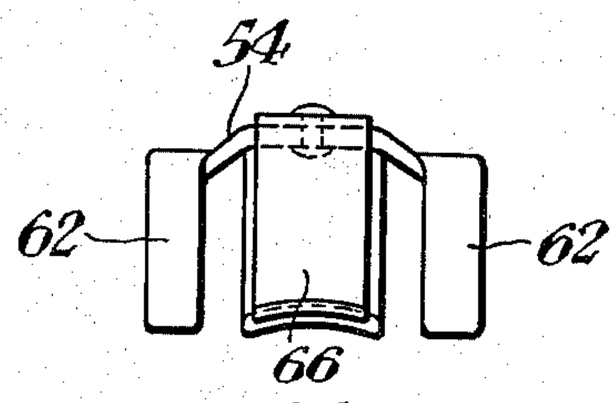

Fig. 9.

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ADJUSTABLE OUTER JAW PIPE WRENCH OF THE FIXED HOUSING TYPE

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12 Claims. (Cl. 81—101)

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This invention relates to pipe wrenches and more particularly to wrenches having an adjustable traveling jaw adapted to pivot on the adjusting means therefor to provide a rocking motion toward and away from the relatively stationary jaw.

Pipe wrenches of the type indicated have been designed with a view to securing a positive pipe gripping action together with ease of release. This so called ratchet action is best controlled by resilient means, such as a spring element, which normally holds the movable jaw in a neutral position substantially parallel with the axis of the bar portion of the wrench. Consequently, a wrench in which the spring action is missing from loss or damage is practically unusable.

This invention includes a spring element having a curved elongate portion bearing at its free ends on a shank portion of the movable jaw of the wrench. The spring is provided with curved fingers on each side of the elongate portion for engaging a housing on the wrench for said shank.

An object of the invention is to regulate the spring-action to a desired amount and to vary the point or points of application without alteration in the basic spring form.

Another object of the invention is to locate the spring securely in position and avoid loosening, loss or breakage thereof even under prolonged use of the wrench as a hammer.

Another object of the invention is to facilitate assembly of the parts and particularly the spring element without the use of tools.

Another object of the invention is to eliminate all but a relatively small rocking motion of the movable jaw so that no lost motion occurs in gripping a pipe.

Another object of the invention is to utilize the spring action to reduce the normal tendency of the wrench to tip sidewise.

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 of a pipe wrench embodying the invention,

Fig. 2 is a side elevation of part of the bar portion of the wrench shown in Fig. 1 during the process of manufacture,

Fig. 3 is an end elevation of the part of the bar portion shown in Fig. 2,

Fig. 4 is a side elevation similar to Fig. 2 but showing the parts following a further step in the manufacture,

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Fig. 5 is an end elevation corresponding to Fig. 4,

Fig. 6 is a perspective view of the spring element, and

Figs. 7, 8 and 9 are plan, side and end elevations, respectively, of a modified spring element.

Referring more particularly to the drawings, the pipe wrench consists essentially of a bar portion 10 carrying a housing 12 and a relatively stationary jaw 14 together with the movable jaw 16 having an adjusting means 18 thereon and being positioned by a spring element 20.

The bar portion 10 is preferably made by forging from high-grade carbon or alloy steel, suitably heat treated, and is provided with a handle portion 22 of a length suitable for the size of the pipe wrench. The opposite end of the bar portion 10, as shown more clearly in Figs. 2 and 3, carries a raised bearing portion 24 having an angular concave bearing surface 26 terminating, at the end opposite the handle, in a heel portion 28 which extends substantially normal to the axis of the bar portion 10. The end of the bar portion 10 opposite the heel portion 28 is provided with an oblique angular face 30 for a purpose which will be explained hereinafter.

As will be observed from Figs. 2 and 3, the bearing surface end of the bar portion 10 carries a plurality of welding buttons in the form of substantially circular projections 32 positioned on opposite sides thereof in spaced relation. In this embodiment, two such projections 32 are located on each side of the bar portion 10 approximately midway between the opposite edges thereof and a third such projection 32 is located on each side thereof but within the area of the bearing surface 24. As will be mentioned later, the welding buttons formed by the projections 32 are in the nature of excresences on the surfaces of the bar portion 10 prior to assembly of the housing 12 but substantially disappear when this assembly is finally completed.

The housing 12 is preferably formed of plate or heavy sheet material, such as steel, and is of U-shaped form having the open end thereof adapted to fit closely over the bearing end of the bar portion 10. Due to the inherent resiliency of the housing 12 such assembly with the bar portion 10 can readily be conducted despite the added thickness of the bar portion 10 due to the presence of the projections 32. Upon application of suitable welding current during a projection welding operation, the housing 12 and bar portion 10 are secured together with their adjoining faces in close engagement due to the

projections 32 substantially disappearing during this welding operation.

The housing 12 as thus assembled has the closed end 34 thereof spaced from the bar portion 10 to form an upper wall while the bar portion 10 forms the lower wall leaving a channel 36 extending substantially parallel with the axis of the bar portion 10. Preferably the closed end 34 of the housing 12 is formed with a curved raised portion 38 to act as a hammer face should the wrench be used for hammering purposes. A transverse passage is formed by a window 40 in each side of the housing 12 and thus intersects the channel 36. Each window 40 is positioned substantially midway between the end faces of the housing 12, and opposite sides of each window preferably converge toward the bar portion 10, the adjacent surface of which is made coplanar with a lower side of each window. An angular recess 41 is provided in the upper right-hand corner of each window 40 as viewed in Fig. 1 of the drawings for cooperation with the spring element 20 to be described. During assembly of the housing 12 and the bar portion 10, each window 40 is carefully located relative to the heel portion 28 so that the latter projects slightly within the window as indicated in Fig. 4 of the drawing for reasons hereinafter described.

The relatively stationary jaw 14 is a separate replaceable item preferably of high grade steel adapted to be seated upon a portion of the housing 12 projecting beyond the oblique angular surface 30 of the bar portion 10. The opposite face is suitably toothed for securely gripping a pipe. This projecting portion of the housing 12 has its two end faces suitably recessed to provide a pair of shoulders 42 which are engaged by the stationary jaw 14 to prevent sliding movement thereof in one direction. The stationary jaw 14 carries a tang portion 44 which extends within the projecting end of the housing 12 in close engagement with the opposite sides thereof and suitable clearance therefor is provided by the oblique angular face 30 of the bar portion 10. A rivet or pin 46 extends through the opposite sides of the housing 12 and through the tang 44 for securing the stationary jaw 14 securely in position. By the construction described, no special machining operations are required to provide for the reception of the jaw 14.

The movable jaw 16 is provided with the usual toothed hook end 48 which is adapted to engage the diametrically opposite portion of a pipe surface from that engaged by the stationary jaw 14. As is customary in pipe wrenches where the movable jaw is positioned approximately parallel with the bar portion, the angle between the jaws 14, 48 is approximately eight degrees before any rocking or tilting motion of the movable jaw 16 occurs. In this embodiment, the movable jaw 16 is provided with a threaded shank portion 50 extending through the channel 36 and being spaced from the upper wall thereof formed by the closed end of the U-shaped housing 12. As in the case of the bar portion 10, the movable jaw 16 is preferably forged from high-grade carbon or alloy steel. The adjusting means 18 takes the form of an annular knurled nut which is of less width than the windows 40 in order to be normally spaced from the side walls thereof and is of a diameter to clear the top and bottom walls also. The adjusing nut 18 is preferably heat treated to provide a good wearing surface thereon for engagement with the heel portion 28 during use of the pipe wrench as will be described.

The spring element 20 forms an important part

of this invention and is shown clearly in one embodiment in Fig. 6 of the drawings. This element comprises a generally rectangular sheet of thin flexible material provided with a pair of open ended slots 52 extending lengthwise thereof and terminating adjacent a neutral portion 54. As thus constructed the slots 52 are spaced one from the other leaving two side portions 56 and one middle strip portion 58 connected at the neutral portion 54. The middle strip portion 58 is provided with substantially an ogee curvature with the free end thereof having a substantially rectangular enlargement 60 thereon and lying in a plane substantially parallel with the neutral portion 54. Thus, the middle strip portion 58 forms a first bowed spring arm section.

The side strip portions 56 have curved retaining fingers 62 formed thereon and these fingers terminate substantially in the plane of the free end 60 of the middle strip portion 58. Preferably, the connection of the side strip portions 56 is displaced from the plane of the neutral portion 54 so that these side strip portions 56 lie below the latter as viewed in Fig. 6.

Projecting from the neutral portion 54 in the opposite direction to the middle strip portion 58 is a second bowed spring arm section 64 which may also have substantially an ogee curvature with the free end thereof lying substantially in the plane of the free end 60 of the middle strip portion 58. The construction provides a pair of oppositely disposed spring arms formed by the portions 58 and 64 and, in effect, a double acting spring is provided. Each of the two spring portions 58, 64 may have different flexibility from each other by being made of differing widths. In this embodiment, the spring arm section 64 is wider than the spring arm section formed by the middle strip portion 58 and hence has less flexibility.

The insertion of the spring element 20 in its proper location is easily accomplished without the use of tools by the method now to be described. The wrench handle portion 22 is grasped in one hand, say the left for a right-handed operator, at a median point so that the bottom of the housing 12 and the end of the handle can rest upon a bench or other supporting surface. The spring element 20 is inserted into the channel 36 by the right hand of the operator which holds the spring element 20 turned sidewise during the inserting operation. When the spring element 20 is located with the retaining fingers 62 thereof opposite the recesses 41, it is turned to its normal position. The left hand index finger and thumb of the operator are used to retain the spring element 20 temporarily in this position.

The next step is to pick up the movable jaw 16 in the right hand by grasping the hooked end 48 as a pistol grip and permitting the threaded shank portion 50 to project forwardly. The projecting end of the shank 50 is then engaged in a downward sloping motion with the spring arm 64 which extends adjacent the open end of the channel 36. Under slight pressure so applied, the spring element 20 will snap into place and the fingers 62 will enter and be tightly held by the walls of the recesses 41. The movable jaw 16 is then withdrawn and the shank portion 50 inserted into the channel 36 while the nut 18 is positioned in the window 40 to receive it. The wrench is thus completely assembled in a matter of minutes by even an unskilled operator. The construction permits removal of the movable jaw 16 and the nut 18 without displacement of the spring element 20.

As will be apparent, the spring arm section 64 projects within the channel 36 forwardly of the window 40 while the spring arm section 58 projects rearwardly thereof to engage the movable jaw 16 at the free ends thereof and to bear thereon at spaced locations. The spring element 20 thus holds the shank 50 of the movable jaw 16 in engagement with the bearing portion 24 and specifically against the curved angular surface 26. When in such position, the movable jaw 16 extends with its shank portion 50 substantially parallel to the axis of the bar portion 10 as shown in Fig. 1 of the drawings.

In the use of the pipe wrench described, the application of pressure on the handle 22 when the jaws 14, 48 are engaged with a pipe will result in an immediate rocking action of the movable jaw 16. Such rocking action involves a pivoting of the movable jaw 16 about the heel 28 as a fulcrum due to engagement of the adjusting nut 18 therewith. The bias of the spring arm 58 is overcome to some extent during such motion of the movable jaw 16 and the angular bearing surface 26 limits the forward movement to approximately five degrees. It will be understood that at no time during such rocking movement does the adjusting nut 18 engage the walls of the window 40 so that no load on the housing to strain the welded connection or cause damage to the housing 12 can occur.

Upon release of downward pressure on the handle 22 during backward ratcheting action, the spring arm 58 is enabled to exert its bias and a reverse rocking action of the movable jaw 16 occurs about the heel 28 as a fulcrum due to the existing engagement of the nut 18 therewith. This reverse rocking motion returns the movable jaw 16 to its normal position substantially parallel with the axis of the bar portion 10.

It will be understood that the lengths of the two separate spring arms 58, 64 can be varied to obtain the described spring deflection in each arm. Moreover, the width of each spring arm is independent of the other and any desired variation can be made. Due to the location of the spring element 20 above the movable jaw 16, the latter is held against the bearing surface 26 and the nut 18 against the heel portion 28. Thus, during ratchet action of the wrench, no sliding action of the nut 18 relative to the heel portion 28 can occur which would tend to cause nut rotation and subsequent loss of gripping action. Moreover, the action of the spring element 20 upon the movable jaw 16, which tends to hold it against the bearing surface 26, causes an instant gripping action on the pipe to occur without any appreciable lost motion of the handle 22. The spring action on the movable jaw 16 is not of sufficient force to prevent free rotation of the nut 18 and easy adjustment of the movable jaw 16. These features are of particular importance when the pipe wrench is used in close quarters as will be apparent to those skilled in the art.

It will be apparent that should the wrench be used as a hammer, by violent application of the surface 38 to an object, there is no possibility of injury to the spring element 20. Thus, even though the adjusting nut 18 is forced against the underside of the retaining fingers 56 adjacent the neutral portion 54 of the spring element 20 during such hammering action, the spring element 20 is not damaged since ample clearance exists between the nut 18 and the neutral portion 54.

A modified form of spring element is illustrated in Figs. 7–9 inclusive. To meet the requirements

for good spring action, it is desirable that freedom of selection of as many of the factors determining such action be facilitated. Thus, the width of the spring, its thickness and arm length as well as the material of which it is made are variable as will be apparent. In the modified form, the generally rectangular sheet of thin flexible material is utilized to form only a second bowed spring arm section 64 and neutral portion 54 having the side strip portions 56 and retaining fingers 62 formed thereon. However, the middle strip portion 66 in this embodiment is a separate element secured by rivets 68 or other suitable means to the neutral portion 54.

The middle strip portion 66 may be made of different material from the other spring portions and the width and thickness thereof determined independently. Similarly, the arm length of the first spring arm section formed by the middle strip portion 66 can be determined freely and independently of the arm length of the second spring arm section 64. In effect, a compound spring element is provided wherein the spring action on the movable jaw 16 of the wrench can easily be varied to obtain desired jaw action in both forward and backward directions. It will be understood, for example, that greater resistance to movement in one direction than another is sometimes required in pipe wrenches. This compound spring can readily be constructed to meet such requirements, it being apparent that the middle strip portion 66 could be integral with the neutral portion 54 and the second spring arm section 64 the separate part if desired.

It will be understood that many changes may be made in the details of construction and arrangement of parts without departing from the invention as defined in the appended claims.

We claim:

1. A pipe wrench comprising a bar portion having a handle and a relatively stationary jaw, a housing carried by said bar portion adjacent said stationary jaw and having a channel therethrough intersected by a passage forming a transverse window in each sidewall of the channel, said bar portion forming a bottom wall of said channel and having a bearing portion projecting between said side walls and within said window at one side thereof, a movable jaw having a threaded shank extending through said channel and being spaced from the upper wall thereof, a spring element in said housing having oppositely disposed arms extending within said space, free ends of said arms bearing upon said shank, said spring normally holding said movable jaw in engagement with said bearing portion and substantially parallel with the axis of said bar portion, said spring having a neutral portion located within said window passage and spaced from both sides thereof, said spring arms having inner ends defining opposite junctions of said neutral portion, said spring element having retaining means connected to said neutral portion between said junctions and spaced from said spring arms and engageable with at least one adjacent side of each window for preventing bodily shift of said spring relative to said housing, and an adjusting nut on said shank positioned within said window passage and engageable with said bearing portion for providing a fulcrum for rocking movement of said movable jaw from said parallel position.

2. A pipe wrench comprising a bar portion having a handle and a relatively stationary jaw, a housing carried by said bar portion adjacent said stationary jaw and having a channel there-

through intersected by a transverse passage forming a window in each sidewall of the channel, said bar portion forming a bottom wall of said channel and having a bearing portion projecting between said sidewalls and within said window passage at one side thereof, a movable jaw having a threaded shank extending through said channel and being spaced from the upper wall thereof, a spring element in said housing having oppositely disposed arms extending within said space, free ends of said arms bearing upon said shank, said spring normally holding said movable jaw in engagement with said bearing portion and substantially parallel with the axis of said bar portion, said spring having a neutral portion located within said window passage and spaced from both sides thereof, a pair of retaining fingers integrally connected with opposite sides respectively of said spring but only at said neutral portion, said fingers extending substantially parallel with an adjacent one of said arms and along adjacent sides of each window, said adjacent sides being recessed to receive said fingers and prevent bodily shift of said spring relative to said housing, and an adjusting nut on said shank, said nut being positioned within said window passage and engageable with said bearing portion for providing a fulcrum for rocking movement of said movable jaw from said parallel position.

3. A pipe wrench as claimed is claim 2 wherein said adjacent one of said arms is of less width than the other said arm for increasing the flexibility of said one arm and lessening the resistance to said rocking movement in one direction.

4. A spring element for pipe wrenches and the like comprising a sheet of flexible material provided with a pair of elongated openings therein terminating in a neutral portion intermediate the ends of said sheet, said openings being spaced one from the other and leaving side and middle strip portions, said middle strip portion having a pair of oppositely disposed bowed spring arm sections having free ends lying substantially parallel to the plane of said neutral portion, said side strip portions terminating short of said middle strip portion and having retaining fingers formed thereon.

5. A spring element for pipe wrenches and the like comprising a sheet of flexible material provided with a pair of elongated openings therein terminating in a neutral portion intermediate the ends of said sheet, said openings being spaced one from the other and leaving side and middle strip portions, said middle strip portion being relatively longer and narrower than said side strip portions and having a pair of oppositely disposed bowed spring arm sections having free ends lying substantially parallel to the plane of said neutral portion, said side strip portions having curved retaining fingers formed thereon.

6. A spring element for pipe wrenches and the like comprising a generally rectangular sheet of thin flexible material provided with a pair of open ended slots extending lengthwise thereof and terminating adjacent a neutral portion, said slots being spaced one from the other and leaving two side and one middle strip portions connected at said neutral portion, said middle strip portion having a first bowed spring arm section and said side strip portions having curved retaining fingers formed thereon, and a second bowed spring arm section projecting from said neutral portion and opposite said first spring arm section, said first and second spring arm sections having free ends

lying substantially parallel to the plane of said neutral portion.

7. A spring element as claimed in claim 6 wherein said first and second spring arm sections are of different widths to provide different degrees of flexibility.

8. A spring element for pipe wrenches and the like comprising a generally rectangular sheet of thin flexible material provided with a pair of open ended slots extending lengthwise thereof and terminating adjacent a neutral portion, said slots being spaced one from the other and leaving two side and one middle portions connected at said neutral portion, said middle strip portion forming a first bowed spring arm section having substantially an ogee curvature with the free end thereof lying in a plane substantially parallel with said neutral portion, said side strip portions having curved retaining fingers formed thereon and terminating substantially in the plane of said free end of said middle strip portion, said connection of said side strip portions being displaced from the plane of said neutral portion, and a second bowed spring arm section projecting from said neutral portion and opposite said first spring arm section, said second spring arm section having substantially an ogee curvature with the free end thereof lying substantially in the plane of said free end of said first spring arm section, said second spring arm section being substantially wider than said first spring arm section to provide relatively less flexibility in said second spring arm section.

9. A spring element for pipe wrenches and the like comprising a generally rectangular sheet of thin flexible material provided with an open-ended slot at one end terminating adjacent a neutral portion, said slot leaving two side portions having curved retaining fingers formed thereon, a first bowed spring arm section secured to said neutral portion and extending in one direction therefrom, and a second bowed spring arm section integral with said neutral portion and extending in an opposite direction therefrom, said first and second spring arm sections having substantially ogee curvatures and having free ends terminating substantially in the same plane.

10. A pipe wrench comprising a bar portion having a handle and a relatively stationary jaw, a housing carried by said bar portion adjacent said stationary jaw and having a channel therethrough intersected by transverse passage forming a window in each sidewall of the channel, a movable jaw having a threaded shank extending through said channel and being spaced from the upper wall thereof, a spring element in said housing having a neutral portion and a pair of spring arms extending in opposite directions therefrom into said space for bearing upon said shank, said spring arms having inner ends defining opposite junctions of said neutral portion, said neutral portion being located within said window passage and spaced from both sides thereof, said spring element having retaining means connected to said neutral portion between said junctions and spaced from said spring arms and extending into operative engagement with one said side of said window passage, and an adjusting nut on said shank and positioned within said window passage.

11. A pipe wrench as claimed in claim 10 wherein said window passage is provided with an angular recess extending from intermediate said sides of said window passage and around said one side thereof, said retaining means being housed within

said recess to prevent bodily shift of said spring element relative to said housing.

12. A pipe wrench as claimed in claim 11 wherein said retaining means comprise a pair of angular fingers extending first substantially parallel with the adjacent one of said spring arms and then substantially normal thereto, said fingers being tightly held by the walls of said recess while said spring arms are free to exert pressure upon said movable jaw.

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