The new adjustable wrench was conceived mainly for fastening and loosening nuts and bolts, based on a simple principle of friction cleats. The quick adjustable wrench is made of five principal parts: the handle (1), the cleat (2), a coil spring (3), the belt (4) and a pin (5); it has also a groove channel (6) into the cleat (2) for inserting the spring (3). A slope surface (7) on the handle (1) provides, with the angle of the cleat (2), the necessary friction force for the belt (4); this one keeps in place the other moving parts. There is a handle cover (8) that limits the belt-stroke. Due to the absence of the worm gear construction of the conventional adjustable wrench, there is no free-play after adjustment on the bolt head has been made, thus providing a safer and faster operation of fastening or loosening. It is an extremely useful hand mechanical tool intended for industries, mechanical-shops, automobiles and domestic shops. The conception of the invention leads to a very practical, versatile and reliable wrench, with a low cost of fabrication.
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QUICK ADJUSTABLE WRENCH.

a) TECHNICAL FIELD
The invention described in this report is referred to a new type of mechanical tool for gripping bolts and nuts, pertaining to the branch of tools for workshops. The invention, hereon, will be denominated "QUICK ADJUSTABLE WRENCH".

b) BACKGROUND ART
The conventional wrenches used heretofore are of the open-ended type, the long-box type, the Stillson's, the monkey type and other variations of these tools. Although very useful, these conventional wrenches still present some difficulties under operation. Everybody knows what kind of damage may occur by using the incorrect size of an open-ended wrench to grip a particular nut or bolt. Even when a conventional adjustable wrench is used, such as the Stillson's type, a little free play will always be present under torque due to the worm gear construction of that tool and this may cause a premature wear of the bolt head or nut.

c) DISCLOSURE OF THE INVENTION
The Quick Adjustable Wrench is based on the principle of the friction cleat. It consists basically of five parts: the handle, the cleat, the belt, the spring and the pin. The spring is inserted into a groove in the cleat and the pin is fixed in a hole in the handle; the pin serves as a guide for the cleat and as a stopper for the spring. The belt envelopes the cleat and the handle. The adjustment of the wrench around a bolt head or nut is done by pushing the belt in order to close the jaws and therefore the cleat will be kept firmly against the bolt head or nut. No back movement is allowed due to the special arrangements of the angles of the cleat, belt and handle. When this last one is forced clockwise to rotate a bolt or nut, the reaction torque will force the cleat up and back and the belt will retain the cleat at the same position through friction.
Figure 1 shows the handle (1), the cleat (2), the spring (3), the belt (4), the pin (5) and a grooved channel (6) into the cleat (2). The handle cover (8) provides a limit for the belt stroke.

On figure 2, it can be seen that the upper portion of the handle (1) has a slope surface (7) with an angle of inclination \( \Theta \). The cleat (2) also presents an angle of inclination \( \alpha \), with the result that the inclination of the belt (4) is \( \alpha - \beta \).

The arrangement of the angles is such that the angle \( \alpha \) is greater than the angle \( \Theta \), both angles situated in the first quadrant and positive as referred to the trigonometric circle.

The shape of the belt (4) is such that two of its faces make an angle equal to \( \alpha \) minus \( \Theta \). The belt (4) can then glide on the slope surface of the handle (1) and cleat (2) and, by this way, can stop the movement of the cleat (2) at any desired position.

To open the wrench is sufficient to pull back the belt (4) so that the cleat (2) will follow this movement, forced by the action of the spring (3) inserted into its groove (6). There is a geometric relation between the velocity of the belt (4) and that of the cleat (2), which depends only on the angles \( \alpha \) and \( \Theta \). This relation is expressed by the following:

Velocity of Belt = \( K \) \cdot Velocity of cleat

where

\[
K = \frac{1}{1 - \tan \Theta \cot \alpha}
\]

It can be easily understood that, ideally speaking, the force available at the wrench jaws will be the force done by the user, multiplied by the same factor \( K \).

The advantages of the quick adjustable wrench as compared to the conventional ones are as follows:

a) - Easy operation due to the fast adjusting movement that can be achieved.

b) - Effective grip due to the lack of free play caused by the worm gear construction of conventional types.
c) - Low cost of fabrication as a consequence of its extreme simplicity.
Safe and reliable operation can be achieved by a good design of the quick adjustable wrench.

5 d) BRIEF DESCRIPTION OF DRAWINGS
The descriptive figures adjoining this application show some details of this invention and are component parts of this privilege application.
Figure 1 is an exploded view of the Quick Adjustable Wrench, showing the principal parts of the invention.
Figure 2 is a lateral view of the wrench, ready for use.

e) BEST MODE OF CARRYING OUT THE INVENTION
There are several alternative processes for the fabrication of the quick adjustable wrench. The one suggested herein shall lead to the least cost of fabrication. The handle and the cleat may be made of forged steel. The spring is just a conventional compression coil spring and the belt may be fabricated from seamless steel tubes, cold pressed to its shape. The pin can be smoothly machined for interference fixture in the handle or even threaded for better fastening. The machining and finishing of the main parts require only conventional machine-tools for these operation. The handle cover may be of any suitable material.

f) INDUSTRIAL APPLICABILITY
The Quick Adjustable Wrench is a simple, reliable and safe hand tool that can be used either as a professional tool for industries and mechanical-shops or as a domestic tool for automobiles and home-shops.
CLAIMS

1 - The invention described in this patent application is referred to a new type of hand mechanical tool for gripping bolts and nuts, pertaining to the branch of tools for workshops and denominated QUICK ADJUSTABLE WRENCH, which is characterized basically by having five components: the handle (1), the cleat (2), the spring (3), the belt (4) and the pin (5); it is also characterized by having a groove (6) on the top of the cleat (2), that serves both for housing the spring (3) and for keeping the cleat (2) pressed against the handle (1), when it is moved back and forth, accordingly to the dimensions of the bolts and nuts.

2 - QUICK ADJUSTABLE WRENCH, according to claim 1, is also characterized by having a pin (a little tongue) (5) at the bottom of the handle (1) that serves to guide and to keep the cleat (2) against the handle (1) all over the stroke of the cleat (2). The pin or tongue (5) also serves as a stopper for the spring (3) housed in the slot (6) of the cleat (2).

3 - QUICK ADJUSTABLE WRENCH, according to claims 1 and 2, is characterized by the fact that, due to the action of the spring (3), the cleat (2), all over its stroke, forces the belt (4) backward and downward. Therefore all parts are maintained at any desired position, due to the friction forces between cleat (2) and handle (1), cleat (2) and belt (4) and belt (4) and handle (1).

4 - QUICK ADJUSTABLE WRENCH, also according to claims 1 and 2, is characterized by having a belt (4) fabricated in such a shape that enables it to support, up to a limit, any force trying to open the wrench under use, not allowing back movements of the cleat (2).

5 - QUICK ADJUSTABLE WRENCH, according to claims 1 and 4, is also characterized by having a slope surface (7) on the handle (1), providing the necessary friction forces for the belt (4).

6 - QUICK ADJUSTABLE WRENCH, according to claims 1, 4 and 5,
is characterized by the special arrangement of the angles inclination between the handle (1) slope surface (7) and cleat (2) and belt (4), enabling the velocity of the belt (4) to be greater than the velocity of the cleat (2). Thus, the available force in the cleat (2) will be greater than the one on the belt (4) by the same factor that links both velocities.
I. CLASSIFICATION OF SUBJECT MATTER

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II. FIELDS SEARCHED

Minimum Documentation Searched

Documentation Searched other than Minimum Documentation
to the extent that such documents are included in the fields searched

III. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>US, A, 1,382,249 Published 21 June 1921, Schaefer</td>
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IV. CERTIFICATION

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International Searching Authority

ISA/US

Signature of Authorized Officer

James G. Smith

Form PCT/ISA/210 (second sheet) (October 1977)
FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. Claim numbers ________, because they relate to subject matter not required to be searched by this Authority, namely:

2. Claim numbers ________, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

   Claims are improper multiple dependent claims and as such are not examinable on the merits.

VI. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This international searching authority found multiple inventions in this international application as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

Remark on Protest:

☐ The additional search fees were accompanied by applicant’s protest.
☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (supplemental sheet (2)) (October 1977)