March 14, 1950 A. LAZZARINI 2,500,462

LEVER AND GEAR SECTOR OPERATED
LOCKING PARALLEL-JAW WRENCH
Filed July 5, 1947

Fig. 1

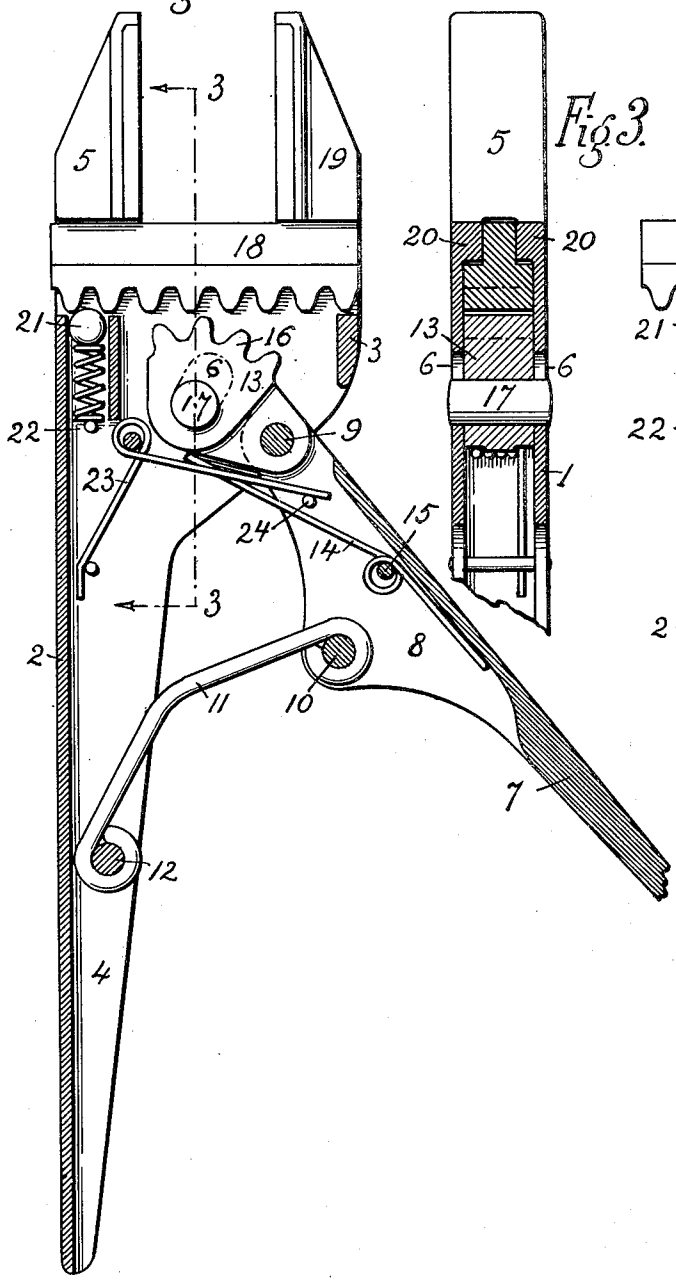
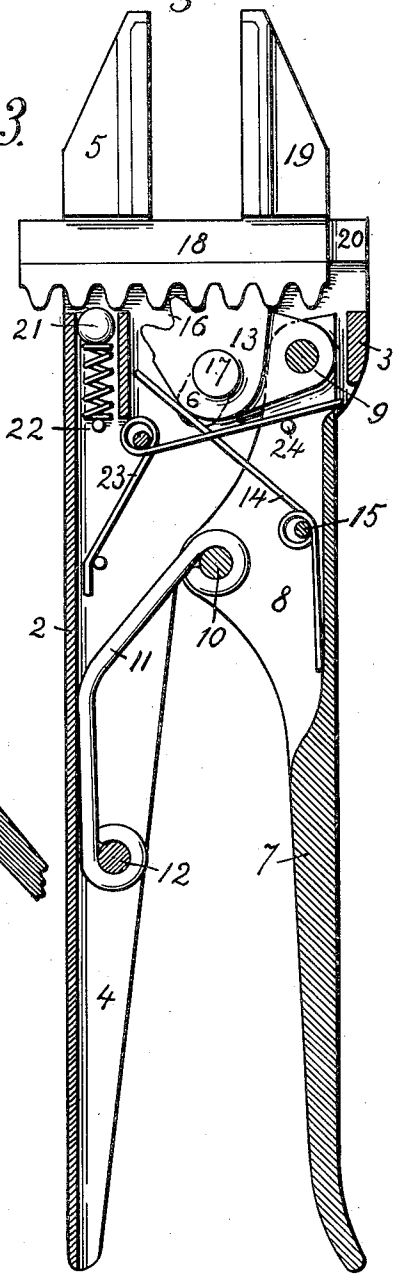


Fig. 3

Fig. 2.



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Patented Mar. 14, 1950 2,500,462

UNITED STATES PATENT OFFICE

2,500,462

LEVER AND GEAR-SECTOR OPERATED LOCKING PARALLEL-JAW WRENCH

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Application July 5, 1947, Serial No. 759,118

3 Claims. (Cl. 81—86)

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My invention relates to improvements in wrenches of the type having the jaws always parallel to one another regardless of the aperture to which it is held.

It also relates to improvements in that category of wrenches, sometimes called multiple lever wrenches or hand-vises, the latter designation being due to their self-locking characteristic.

As such it differs from another parallel wrench which I invented and has made the subject of an earlier patent application #756,928.

The object of this invention is to produce a tool having a powerful grip due to its high leverage but being adaptable at the same time to a comparatively broad range of work. Ordinarily, the higher is the leverage, the smaller is the range of work, due to the small maximum aperture of the jaws. In this invention the jaws are pre-set so as to operate from initial varied apertures, such pre-setting being attained almost instantaneously and with very little effort. In fact, preparatory adjustments by means of thumb screws and the like, involving the guessing of the entity of the final gripping aperture, are with this invention eliminated.

I attain these objects with a device whose design is illustrated in the accompanying drawings and whose operation I now undertake to describe.

Fig. 1 is a view of this device as one would see by removing one side wall of that portion which constitutes the housing. In this figure the working position represented is the open one.

Fig. 2 is a similar view as the above, but showing the wrench in the closed position.

Fig. 3 is a sectional view of the upper part of the wrench, or body (for space convenience the handle portion is broken away), along line 3—3 of Fig. 1.

Similar numerals refer to the same parts as illustrated in all figures.

A main part, designated with small numeral 1, constitutes a housing enclosing the other parts of the tool's body. It is formed by two flat walls held parallel by return portions 2 and 3. A tapering elongation 4, extending downward, forms one of the pair of handles of the wrench. Also one of the jaws, 5, is integrally a part of the same housing, straddling the two flat walls of the same at the top.

An oblong perforation in both walls of the housing is indicated by dotted line at 6. This perforation follows an oblique direction for a purpose which will be later explained.

A lever, 7, provides the second handle of the usual pair. The upper portion of the same lever-

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handle forms a fold providing a cavity, 8. The sides of said fold extend and form two yokes where, inserted in suitable perforations, are wrist-pins 9 and 10. An arm, 11, which preferably will have a small resiliency and is therefore made of spring-steel, connects said lever-handle to the body's fixed handle extension by means of wrist pin 10 at one end, and fulcrum pin 12 at the other, thus making a toggle assemblage.

A head-piece, 13, has an extending lobe with a perforation, which is held in articulate connection with the upper yoke of handle-lever 7 by wrist-pin 9. The articulated movement of this joint, however, is restrained by an abutting stop formed by said yoke, wherein the head-piece may not swing farther than shown in Fig. 1. It is in the above position that the head-piece 13 is normally kept when idle. A coil spring of the angular thrust type, 14, held by pin 15 within the cavity of the lever-handle, will perform this task by pressing upwards from under said head-piece.

Upon the summit of head-piece 13 is cut a gear-sector 16. Through a suitable perforation co-centered with the gear sector, a fulcrum-pin 17 is forced in, being locked therein by friction, and symmetrically protruding its ends into oblong perforations 6 of the side walls, as shown in Fig. 3. It will be noted that the outline of the perforations 6 of the side walls permit the fulcrum-pin a shifting play of limited extent and respectively illustrated in Fig. 1 (down) and Fig. 2 (up). Obviously the perforations of the two walls will be perfectly aligned.

A toothed bar or rack 18, which has a section profile similar to a T turned upside-down (see Fig. 3), is slidably fitted to suitable guiding tracks 20, formed at the upper edge of the walls of housing 1, and projecting inwardly.

The teeth of such rack are intermeshable with the gear sector 16.

Both the gear sector 16 and rack 18 are as broad and strong as possible, their teeth extending in width from wall to wall of the housing.

The other jaw of the required pair, 19, is an integral part of rack 18, the latter being its sliding base.

Located between the flat walls of the housing 1 is a partition which will provide a small compartment for a spring-and-ball latch 21, while a small pin, 22, will retain the spring of same at the bottom and provide convenient access for assembling the parts.

The ball of said latch is pressed by the spring over and in between the teeth of rack 18, causing

said rack to normally stop at a varied degree of displacement along its tracks as may be induced by manipulation.

The open inoperative position of this wrench is as illustrated in Fig. 1, with the two handles 4 and 7 spread far apart. An angular thrust coil spring, 23, held within the fixed handle 4 as illustrated, and pressing down upon pin 24 located within the fold of handle-lever 7, will cause the latter to swing in the open position.

For the purpose of storage, the closed position may be held despite the action of coil spring 23 due to the ability of this tool to lock itself in such closed position, as will presently be explained.

In visualizing the movement of the combination of levers represented by the parts designated as 11, 7 and 13, it will be observed that they go from the respective positions shown in Fig. 1 to those of Fig. 2 in a toggle action manner, causing the small pin 24 to rise counteracting the spring 23. Wrist-pin 10 describes an arc and by the time it has reached the position indicated in Fig. 2 it has crossed an imaginary straight line between wrist-pin 9 and pin 12. This puts it beyond a "dead point," where any pressure exerted downward in the approximate direction of said straight line upon pin 9, cannot accomplish the result of lowering its position until the lever-handle 7 is purposely swung apart to an extent sufficient for wrist-pin 10 to retrace its arc to the right past the dead point. Until that has occurred, all levers must remain immobilized, that is, locked.

In putting this tool to use, the first step is to spread the handles apart if they don't happen already to be. By a single hand operation, this is done with a slight jerk of the small finger's knuckle, which will immediately activate spring 23 in overcoming the "dead point" of the levers.

The action of spring 23, not only will cause the handle to swing apart, but, on account of the play of pin 17 within the oblong perforations 6 of the housing walls, the head-piece 13 will descend at the same time as far down as said oblong perforations will permit. At that time the teeth of gear sector 16 will have become disengaged from those of rack 18. In such situation the rack 18 is readily caused to shuttle one way or the other by hand-pressing the jaws together or, reversely, by pressing the jutting end of the rack 18 into the housing. The spring-and-ball latch will momentarily hold it in the desired position. Thus an aperture is set for the wrench's jaws which is most suitable for the work to be performed, that is, an aperture slightly wider than the gripping hold will attain.

By experimentation it has been found that the pre-setting of the jaws requires at most an aperture of only as much as the equivalent of one and one-half tooth spacing in excess of the final gripping aperture. By wide-opening the jaws and then close them upon the object to be gripped, a very easy and speedy adjustment is accomplished.

Now, drawing the handles together, the levers will operate as already explained. The head-piece 13 being kept in the extended position by spring 14 will rise until its gear sector 16 is in engagement with rack 18. This movement is guided by the oblique perforations 6. When the pin 17 has reached the play limit permitted by said perforations, the head-piece will begin to pivot therein while the articulate joint of wrist-pin 9 will become operative despite the pressure of spring 14 to the contrary.

As the head-piece rotates, the rack 18 is impelled to slide and force the jaws to close.

This is the positive gripping action.

As it involves a small displacement of the jaws, and as the ratio of leverage is very high especially when the levers are approaching the "dead point," the gripping power is correspondingly great.

During the gripping action of the jaws, the thrust of the gear sector 16 upon the resisting rack 18 would tend to cause the meshed teeth to slide off engagement. To prevent that, the counter thrust developed by fulcrum-pin 17, which is in the opposite direction, is taken advantage of.

That is the purpose of the obliquity of the wall perforations 6. The counter-thrust of the fulcrum-pin 17 upon the upward inclines of said perforations will tend to keep the teeth meshed as they are, the more gripping resistance, the better.

To release the holding grip, the lever-handle 7 must be swung apart from handle 4 past the "dead point" of the levers (as already explained), but on account of the counter-action of the powerful grip which has locked the levers very tightly, a small effort may be required to open the handles. Once the levers surmount the dead point in the opening direction, spring 14 will cause all moving parts to return all the way to the open position.

A new feature in the operation of this invention may be attained by a slight modification in the shape of spring 14. Such modification consists in curving the upper end of said spring in a manner as to partly envelop the gear sector head when the latter is flexed upon the lever handle as shown in Fig. 2. Such curvature of the spring end will serve to hold said gear sector head in this position even while it descends during its disconnecting phase. However, it will suddenly extend from the flexed position upon reaching the lower limit of its displacement. The resultant effect will be to avert any retracing step of the toothed rack 18, hence the jaws may be made to furtherly close, step by step, at each successive stroke of the handles.

Having thus described my invention, I claim:

1. A parallel self-locking wrench composed of a housing body having two main walls and a projecting stationary jaw and a fixed handle extending oppositely said jaw; a movable jaw opposing said stationary jaw and having a base forming a toothed rack which is adapted to slide transversely within the housing body; a lever handle; connecting means resiliently linking said lever handle and said fixed handle to form a toggle; a gear sector pivotable within the housing body upon a fulcrum provided by trunnions emerging from the opposite faces of the gear sector and projecting into a pair of co-aligned oblong perforations of the two main walls of the housing body, such gear sector also having a radial protuberance which is connected by articulate joint to the work-end of said lever handle.

2. A parallel self-locking wrench composed of a housing body having two main walls and a projecting stationary jaw and a fixed handle extending oppositely said jaw; a movable jaw opposing said stationary jaw and having a base forming a toothed rack which is adapted to slide transversely within the housing body; a lever handle; connecting means resiliently linking said lever handle and said fixed handle to form a toggle; a gear sector pivotable within the housing body upon a fulcrum provided by trunnions emerging from the opposite faces of the

gear sector and projecting into a pair of co-aligned oblong perforations of the two main walls of the housing body, such gear sector also having a radial protuberance which is connected by articulate joint to the work-end of said lever handle; a spring for biasing said gear sector toward the toothed rack, and a second spring normally acting to swing said lever handle away from the fixed handle.

3. A parallel self-locking wrench composed of a housing body having two main walls and a projecting stationary jaw and a fixed handle extending oppositely said jaw; a movable jaw opposing said stationary jaw and having a base forming a toothed rack which is adapted to slide transversely within the housing body; a lever handle; a bow spring rod resiliently linking said lever handle and said fixed handle to form a toggle; resilient stop means for restraining the sliding motion of said toothed rack; a gear sector pivotable within the housing body upon a

fulcrum provided by trunnions emerging from the opposite faces of the gear sector and projecting into a pair of co-aligned oblong perforations of the two main walls of the housing body, such gear sector also having a radial protuberance which is connected by articulate joint to the work-end of said lever handle; a spring for biasing said gear sector toward the toothed rack, and a second spring normally acting to swing said lever handle away from the fixed handle.

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