

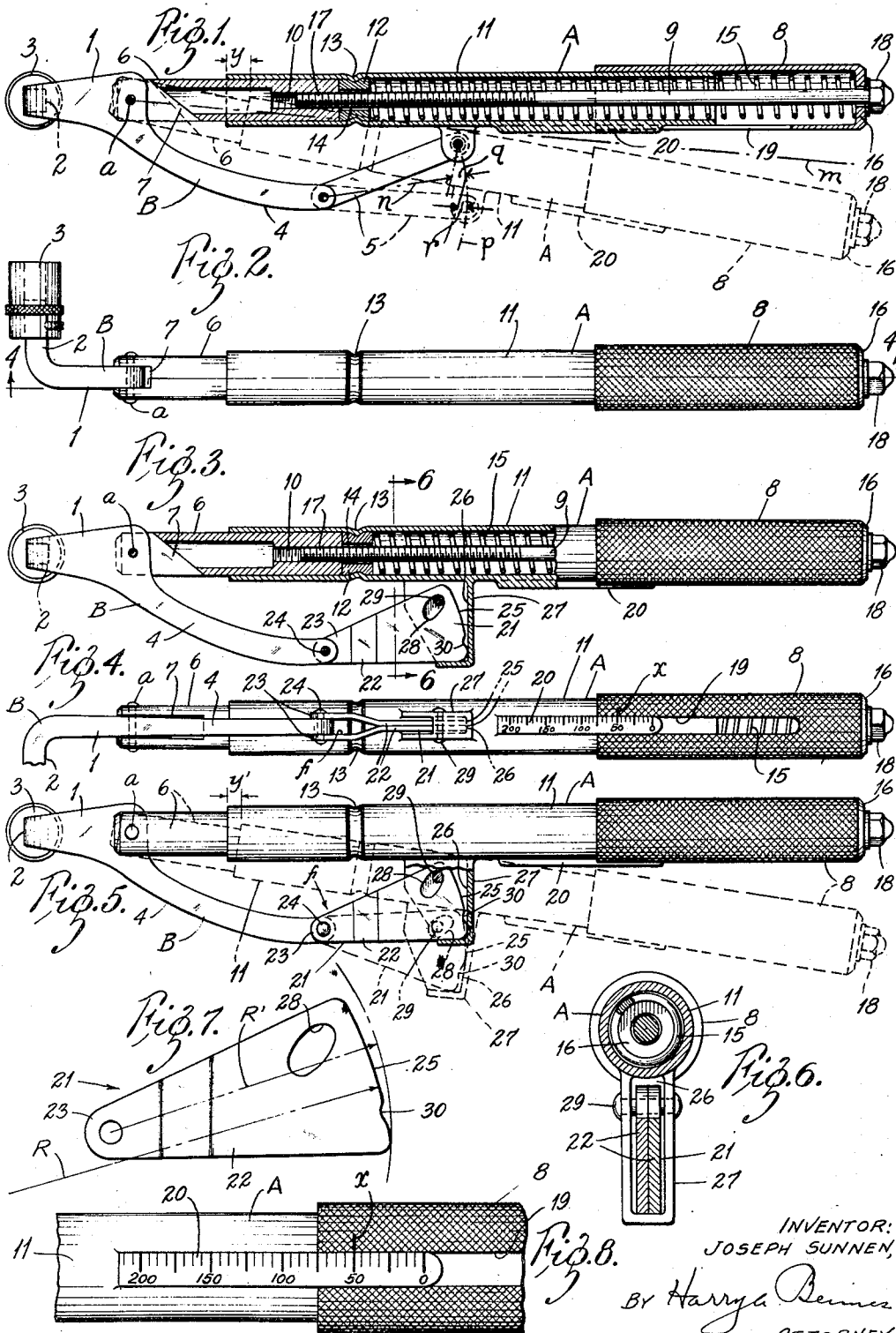
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SAFETY WRENCH

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SAFETY WRENCH

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My invention has relation to improvements in safety wrenches and it consists in the novel features of construction more fully set forth in the specification and pointed out in the claims.

By safety wrench I mean a wrench that embodies means for indicating to the operator when he has reached the limit of safety of force applied to the nut or other object being worked upon. For this purpose, the handle is collapsible with respect to the working jaw, said jaw and handle being held in operative relation by a spring, or equivalent device, adapted to exert a definite force, which force is overcome by the operator when he exceeds the force that may safely be applied to the work piece.

A further object of the invention is to provide a wrench of the character above set forth in which the force resisting the collapse of the wrench handle is adjustable within wide limits so that the tool may be adapted to many kinds of work.

A further object of the invention is to provide the handle with a scale for indicating the pressure at which the spring is set, thereby eliminating guess-work and enabling the operator to set the wrench accurately at all times.

Further and other advantages will be better apparent from a detailed description of the invention in connection with the accompanying drawing, in which:

Figure 1 is a side elevation of one form of my improved wrench, with parts broken away and the handle shown dotted in collapsed position.

Figure 2 is a top plan view of the form shown in Fig. 1; Fig. 3 is a combined side elevation and middle longitudinal section through another form of my improved wrench; Fig. 4 is a bottom plan view of the wrench shown in Fig. 3; Fig. 5 is a side elevation of the wrench shown in Fig. 3, with parts broken away and the handle shown dotted in collapsed position; Fig. 6 is a cross-sectional detail taken on a plane indicated by the line 6-6 of Fig. 3; Fig. 7 is a side elevation of the cam associated with the working jaw lever and the handle lever; and Fig. 8 is an enlarged plan view of a fragment of the handle showing the scale thereon for indicating the spring compression.

Referring to the drawing, and for the present to Figs. 1 and 2, A represents a handle lever and B represents a working jaw lever pivotally connected by a pin *a*. The lever B has a forwardly projecting arm 1 terminating in a laterally extending shank 2 of polygonal shape for receiving a socket member 3. Obviously, the wrench

may be used either with or without the socket member 3, as well understood in the art. The lever B has a rearwardly extending arm 4 pivotally connected to the handle lever A by a link 5.

The handle lever comprises a hollow cylindrical member 6 having its outer end bifurcated, as shown at 7, to receive the jaw lever B to which it is pivoted by means of the pin *a*, and a tubular member 8 connected to the member 6 by means of a rod 9 screw-threaded into a tapped opening 10 in the inner end of the member 6.

Between the member 6 and tubular member 8 is an intermediate tubular member 11 having telescopic connection with said members 6 and 8. An abutment partition 12 is fixed within the tube 11 by swaging 13 and is provided with an axial bore 14 through which the rod 9 passes with suitable clearance. A coiled spring 15 envelopes the rod 9, bearing at one end against the partition 12 and at the opposite end against the end wall 16 of the tubular member 8. The spring is held between the partition 12 and end wall 16 under compression, the degree of which may be adjusted by advancing or withdrawing the screw-threaded extremity 17 of rod 9 in the tapped opening 10. The outer end of the rod 9 is provided with a nut 18 to facilitate the rotation of the rod to effect this adjustment.

A longitudinally extending open slot 19 is provided in the tubular member 8 and receives a scale plate 20 projecting from the surface of the tube 11, and a base mark *x* is indicated on the sleeve 8 to which the calibrations of the scale 20 are referred in order to determine the compression imposed upon the spring 15. In other words, when the zero mark of the scale is opposite the base mark *x*, the spring is under no compression; but if the nut 18 is rotated to advance the rod 9 into the tapped opening 10, the tube 8 will slide forwardly over the tube 11, causing the base mark *x* to travel over the scale 20, indicating as it moves the pounds pressure imposed upon the spring 15.

In the operation of the form of wrench shown in Figs. 1 and 2, we will assume that the wrench is to be used for tightening the nuts on an engine cylinder head. We will also assume that the threads of these nuts can safely withstand a force of 200 pounds.

The operator's first step then is to adjust the compression of the spring 15 so as to obtain a reading of 200 pounds on the scale 20. The operator now proceeds to apply the wrench to the nut and when the latter has been tightened sufficiently so that the torsional stress is equal to the

200 pound compression imposed upon the spring 15, any further stress applied to the nut through the wrench will cause the handle A to rotate on the pivot *a* and effect a compression of the spring 15 as the handle A and the link 5 assume the dotted positions shown (Fig. 1). Thus, when the force applied to the nut exceeds that which may safely be withstood, the handle A "breaks down," and the operator is warned that he has reached the limit of safety and no further tightening should be effected.

It will be observed, by comparing the dotted position of the handle A with its full position (Fig. 1), that the tubular member 11 has moved a distance equal to *y* relative to the members 6 and 8, during which movement the spring 15 has undergone further compression. By referring to the dot and dash lines (Fig. 1), it will be seen that the arrangement of the levers 4 and 5 is such that the leverage applied to the compression of the spring 15 increases as the handle moves toward the working jaw lever B. The center line of the handle is represented by *m*, and the center line of lever 5 by *n*. The outer pivot of lever 5 travels along the arc *p*. Hence when the handle is moved to cause the lever 5 to travel one-half the distance between the positions indicated by the full and the dotted lines, the spring 15 will have been compressed an amount equal to *q*; and for the last one-half of the movement of the handle, the spring 15 will compress only an amount equal to *r*.

It is apparent that *r* is considerably less than *q* although the handle has been moved through the same length of arc. Hence the force that resists the turning effort of the operator in "breaking down" the handle decreases from the maximum at which the wrench is set to approximately zero as dead center is approached.

In order to hold the amount of this relative movement and resulting compression of the spring 15 to a minimum, I have devised the form shown in Figs. 3 to 7, which will now be described. In this form, the link 5 is replaced by a cam lever 21 formed of two members 22, 22 spread apart at their inner ends 23, 23 to provide a fork *f* for receiving the free end of the arm 4 to which the cam lever 21 is pivotally secured by a pin 24. The outer ends of the members 22, 22 have cam surfaces 25, 25 formed on them, which collectively form a single cam held in contact with the inner surface 26 of a slotted lug 27 in which the cam lever 21 operates. The members 22, 22 are provided with aligning slots 28, 28 which are traversed by a pin 29 fixed in the side walls of the lug 27.

The shape of the slots 28, 28 is such as to permit freedom of movement of the pin 29 during the operation of the wrench, and the primary function of the pin 29 is to prevent the cam lever 21 from being pulled out of the slotted lug 27 when the wrench is used in a counter-clockwise direction for loosening nuts or bolts.

In Fig. 7, I show an enlarged view of the cam lever 21 from which it may be observed that the cam surface 25 is described by the radius *R* somewhat longer than the radius of rotation *R'* about which the lever moves during the operation of the wrench. The purpose of thus drawing in the cam surface 25 is to shorten the distance between the pivot pin *a* and the point of tangency of the wall 26 with the cam surface 25 as the wrench handle A is moved downwardly to its dotted position (Fig. 5). The effect of shortening this distance by shaping the cam surface 25, as

just described, obviously will shorten the distance of travel of the tube 11 so that instead of travelling the distance equal to *y* (Fig. 1), this travel will be reduced to *y'* (Fig. 5).

Thus, there are two features in the form of wrench illustrated in Figs. 3 to 7 that combine to shorten the travel of the tube 11 with the resulting compression of the spring 15. The one feature is the replacing of the link 5 with the cam lever 21 which operates as a roller; and the other feature is the describing of the cam surface 25 from the radius *R* instead of the radius *R'*, which would give it a true roller shape.

In operating the form of wrench shown in Figs. 3 to 7, when the force applied to the nut, or other object being operated upon, exceeds the force exerted by the spring 15, the handle A will pivot about the pin *a* and as the slotted lug 27 moves downwardly in contact with the cam surface 25, the cam lever 21 will rotate about the pivot 24, said cam surface 25 rolling over the surface of the wall 26 until the limit of movement of the handle A is attained. Obviously, the slot 28 is of a size and shape to permit freedom of movement of the pin 29 therein. When the operator relaxes his hold upon the handle A, the force exerted by the spring 15 will restore the wrench to its normal position. When the wrench is used for the purpose of loosening a nut by rotation in a counter-clockwise direction, the pin 29 pulls upwardly on the cam lever 21, which in turn pulls on the lever 4, thus transmitting the turning effect imparted to the handle A to the socket 3 mounted on the end of the lever 4, as heretofore explained.

The construction of the handles in the two forms of wrench illustrated is the same, and the details thereof, as illustrated in the drawing, are to be considered as applying to either form. It is obvious that other modifications of the invention may be effected without in any wise departing from the spirit of the same, and I therefore do not wish to be restricted to the specific features of construction shown. For example, instead of the cam surface 25, as illustrated in Fig. 7, a true roller shape may be adopted with but little sacrifice of efficiency in the operation of the tool.

In order that the operator may be definitely apprised (even though he may not be looking at the wrench while working it) of the "breaking down" of the handle A, a notch 30 is formed in the cam surface 25 and as this notch moves over the wall 26, there will be a slight bump to indicate to the operator that the handle has started to rotate about the pivot *a*.

From the foregoing it is apparent that the torque of the wrench may be definitely controlled so as to give absolute assurance to the operator that the force applied by the wrench will remain within the limits of safety, and thereby avoid strain on the work-piece. Of course, it is possible to operate the wrench after the collapse thereof and apply any force to the work-piece; but this is not the intended mode of operation and no intelligent operator will continue to apply force to the work-piece after the collapse of the wrench. While I have heretofore referred to the wrench as a safety wrench, it may more specifically be designated as a controlled torque wrench.

Having described my invention, I claim:

1. In a wrench, a jaw member having a lever arm extending therefrom, a handle pivotally connected to the member intermediate its ends, a brace connected between the lever arm and the

- handle normally holding the lever arm and handle in angular relation, a spring between the handle and the brace and exerting its tension therebetween to maintain said angularity, and means for compressing said spring when the handle is moved into alinement with the lever arm, the relative positions of lever arm, brace and handle being such that the handle leverage increases as the spring is compressed.
2. In a wrench, a jaw member having a lever arm extending therefrom, a handle associated with said jaw member, said handle having telescopically arranged sections, one of which is pivotally connected to the member intermediate its ends, a brace connected between the lever arm and the other handle section, a spring between the handle sections exerting its tension to hold the lever arm and handle in angular relation, and means for compressing said spring when the handle and lever are moved into alinement, the relative positions of lever arm, brace and handle being such that the handle leverage increases as the spring is compressed.
3. In a wrench, a jaw member having a lever arm extending therefrom, a handle pivotally connected to the member intermediate its ends, a brace pivotally connected between the lever arm and the handle normally holding the lever arm and handle in angular relation, a spring between the handle and the brace and exerting its tension therebetween to maintain said angularity, means for compressing said spring when the handle is moved into alinement with the lever arm, and said brace having an arcuate surface and the handle having an abutment member in contact therewith whereby rolling contact is provided between the brace and the handle when the latter is moved angularly with relation to the lever arm, the radius of said arcuate surface being greater than and eccentric to the radius of an arc circumscribed from the pivotal point of the brace and in contacting relation with said arcuate surface.
4. A wrench comprising a handle and a crank pivotally connected at one end of said handle, said crank being disposed at an angle to the handle and having a working jaw on the outer end, a lever pivotally connected on the inner end of said crank, an abutment member on the handle in proximity to said lever, said lever having a circular cam surface at its free end in rolling contact with the abutment member the radius of the cam surface being greater than the distance from said surface to the pivotal point of the cam lever, and a spring disposed between the handle and the cam lever arranged to exert its force for maintaining contact between the cam surface and the abutment member and an angular relation between the crank and the handle.

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