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RATCHET AND CAM ACTUATED TOOL

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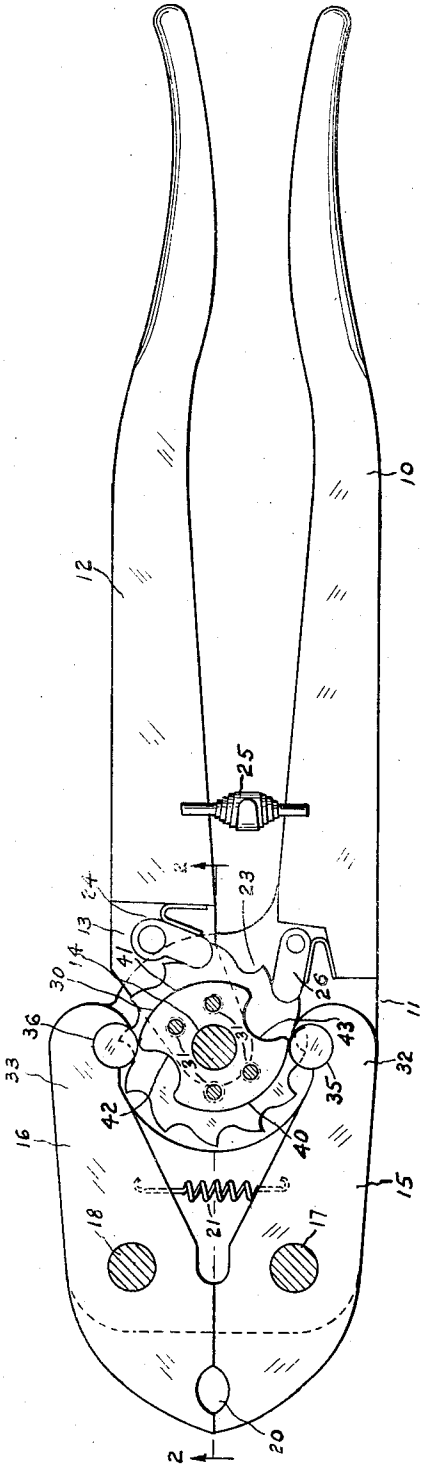


FIG. 1

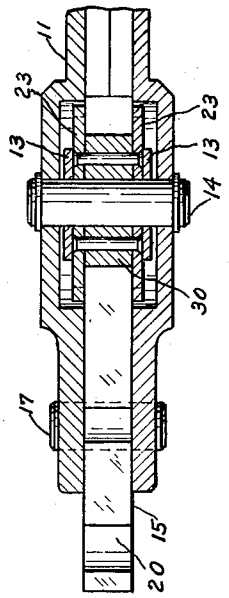


FIG. 2

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RATCHET AND CAM ACTUATED TOOL

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2 Claims. (Cl. 81—15)

This invention relates to cam actuated tools, and more particularly to a closable jaw hand tool of light weight and rigid construction for crimping or indenting workpieces such as electrical connectors.

This application is a division of an application filed by Walter J. Rozmus on February 8, 1956, on an improved "Ratchet and Cam Actuated Tool," Serial No. 564,165.

The primary object of this invention is to provide a movable jaw tool having a wide jaw opening, fast closure to a work position, high mechanical advantage through the work closing cycle, and assurance of completing a full work cycle whereby the jaws are required to close to a specific relative position before opening.

More specifically, an object of this invention is to provide a revolvable power cam having a peripheral surface defining a cam track, with an even plurality of driven members each of which is provided with a rollable cam follower to take driving power from the cam surface, and the cam having definite recess pockets providing quick return from a maximum actuation position to a starting position.

When using plier-type tools for crimping electrical connectors and severing heavy workpieces, or other similar high pressure jobs, it is customary to provide long handles to reduce operator fatigue, or to bring the mechanical advantage to such a degree that the desired operation is possible. Long handles or levers require less input force to do the required work and provide a high mechanical advantage. Lengthening the handles, however, introduces other undesirable factors. The longer the handle, the wider is the spread between the ends of the handles, and this makes the long levered pliers unlikely for use in confined quarters, more difficult to use, and induces early oprator fatigue.

Another object of this invention, therefore, comprises the provision of pliers having a large mechanical advantage with a small span at the ends of the opened levers.

A further object of the invention is to provide a novel and improved hand tool in which a pair of crimping jaws are provided, each of which has a work performance end, a drive receiving lever portion, and a pivot interposed between the crimping end and the drive receiving lever portion, and in which such jaws are actuated by a power cam, revolvable about an axis between the drive receiving lever portions to actuate the jaws with a balanced wedge force, applied by opposite sides of the cam.

Further objects are to provide a short span lever actuated tool having a long lever characteristic, the jaws of which open wider than can be expected of ordinary pliers of similar size, and to provide such a tool having the foregoing characteristics which are relatively light in weight and which do not require close tolerances in manufacture that are difficult to obtain in mass production.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing in which:

Figure 1 is a side elevational view of a pivoted jaw tool designed principally for crimping electrical connectors, and in which the crimping action is obtained through the improved drive device of this invention; and,

Figure 2 is a fragmentary sectional view of the device of Figure 1 as seen from the plane indicated by the line 2—2 of Figure 1.

In the past, reliance has been principally upon fulcrum type of tools, employing single or multiple fulcrums. Sometimes these tools have been supplied with a link mechanism attached to the handles permitting a variable mechanical advantage. The well-known bolt cutter is such a tool design. In this construction, handles are pivoted together and are rearward extensions of the opposed pivoted jaws. The ratios are fixed. The jaws will not open wide to receive work. They have terrific power at completion of the closure and no guarantees that the operator will complete the closure. This type of tool has stresses perpendicular to the length of the tool but provides no variation at the jaw from a uniform curve of force. Such tools are heavy, rugged, and the handles must be opened wide, making them one-stroke, two-handed tools.

Later developments brought about the use of tools having a fixed anvil and a movable anvil. The movable anvil was generally actuated by means of a pivoted cam surface or a jack step device. Such devices require rugged actuation structures because of the very large reaction stresses placed upon the pivotal mounting for any such actuation device. As a result, a large amount of this input power is consumed in overcoming frictional loads and the pivotal supporting surfaces are subject to rapid deterioration under high wear conditions.

This invention is a further development of the basic principles set forth in an application entitled "Ratchet Powered Tool" filed January 17, 1956, and bearing Serial No. 559,605, and an application entitled "Pivot Lever Retainer for Ratchet Powered Devices" filed January 30, 1956, and bearing Serial No. 562,253.

Referring to the drawing, a handle **10** is rigidly fixed to a frame structure **11**. A second handle **12** is fixed to the frame structure in a relatively pivotable fashion. The handle **12** has a pair of end extensions **13** which are pivotally fixed to a drive pivot pin **14**. The pivot pin **14** in turn is carried by a frame **11**.

First and second jaw members **15**, **16** are pivotally carried on jaw pivots **17**, **18** respectively. The tool as shown in the drawing is in a closed position for a crimping operation in a crimping region **20**. A spring **21** is fixed to the jaws **15**, **16** to urge the jaws toward an open position.

The jaws **15**, **16** are shifted from an open to a closed position by a novel and improved uni-directional drive mechanism. This drive mechanism includes a pair of ratchet wheels **23** which are pivotally carried by the pin **14**. The handle **12** carries a pair of drive pawls **24**, only one of which is shown. As the handle **12** is pivoted to an open position, the pawls **24** index from one tooth to an adjacent tooth of the associated ratchet wheel **23**. The handle **12** is then pivoted towards the handle **10** against the action of spring **25** to cause the ratchet wheels **23** to advance. A pair of spring loaded detents, **26**, only one of which is shown, are pivotally carried by the frame **11**. The detents **26** index from tooth to tooth in the ratchet wheels **23** as the wheels are advanced by manipulation of handle **12**. The detents hold the ratchet wheels against reverse rotation. A jaw actuation cam **30** is fixed to the ratchet wheels **23** to pivot with them about the drive pivot **14**.

The jaws **15**, **16** have drive receiving lever portion ends **32**, **33** respectively, and are provided with cam riders **35**, and **26** respectively. The lever portion ends **32**, **33** define

an included field area. The cam **30** is located in this field area, and it is in driving connection with roller cam riders **35, 36.**

It will be seen that the axes of the rollers **35, 36** and the drive pivot **14** are in parallel alignment so that drive forces are applied to the pivot in a balanced fashion, thereby minimizing the required size of the pivot. That is, since the jaws are in opposition upon the same workpiece, and since both are substantially identical, the ends **32** and **33** will exert substantially equal resistance to outward separation movement, and will exert substantially equal reaction force. Riders **35** and **36** are placed in a straight line relationship across the cam **20,** which line is parallel through the pin **14.**

As a practical matter, because the work receiving ends do swing about the pivot mounting, this line will shift somewhat with respect to the fixed axis of pin **14.** Nevertheless, the line remains substantially at such a location that it does pass through the pin **14.** When roller cam riders are employed the three axes of the two rollers and the pin **14** are in parallel alignment also. Thus, the reaction forces are balanced against one another across the cam with virtually no effect on the pin **14.** Thus, the pin is quite small and has no substantial performance requirements.

The revolvable cam **30** has first and second drive surfaces **40, 41** and first and second pocket recesses **42, 43.** In Figure 1, the rollers **35, 36** are in contact with the drive surfaces **40, 41** at the point where the surfaces are the maximum distance from the axis of rotation. This is the conclusion of a crimping cycle. As the cam **30** is indexed clockwise by the ratchet mechanism, the rollers drop into the pocket recesses **43, 42** as the jaws shift under the urging of spring **21.** This concludes a work cycle and the jaws assume an open position. To connect a terminal to a wire the terminal and wire are next placed in the crimping region **20.** The handle **12** is then manipulated to index the ratchet in a clockwise direction. The rollers **35, 36** quickly ride up onto the drive surfaces **40, 41.** This causes a quick closing of the jaws to start a work cycle. Thereafter a gradual and high mechanical advantage closing is achieved through the gradual eccentricity of the surface **40, 41** progressively forcing the jaws closed as the ratchet is advanced.

It will be seen that this particular construction has several inherent advantages. Quick closing of the jaws with low mechanical advantage to index them to work operation position is provided. Thereafter, very gradual closing under high mechanical advantage is achieved so that relatively high crimping pressure can be obtained with a small hand tool. Further, the rotation of the ratchet and cam is uni-directional so that once a work cycle is started it must be completed before a workpiece can be removed, this assures a thorough crimping.

In the preferred and disclosed embodiment, there are two drive recesses and two pocket recesses. It will be recognized that to achieve balanced pressure on a pair of jaws and equal movement of the jaws, it is necessary that the cam surfaces be in multiples of two. To achieve the highest mechanical advantage with the smallest tool possible, the preferred arrangement has two such cams, and one work cycle requires 180 degrees of ratchet rotation.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred embodiment is made only by way of example and that numerous changes in the details of construction and the combination of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A work performing tool, comprising, a first and a second pivoted and relatively closable jaw, said first jaw having a work performing portion and a drive receiving lever portion with a pivot therebetween, said second jaw having a work performing portion and a drive receiving lever portion with a pivot therebetween, each drive receiving lever portion being mounted for movement in a work cycle path, the two drive receiving lever portions being laterally spaced and jointly defining an included field area, a rotatable cam member in said field area, said cam member having a peripheral cam surface revolvable about an axis of rotation, said cam surface composed of a first and a second drive surface area with a first and a second pocket recess spaced between the first and second drive surfaces, each of said first and second drive surfaces beginning at one of said pocket recesses and ending at the other, said first jaw drive receiving lever portion having a cam rider, said second jaw drive receiving lever portion having a cam rider, means urging said cam riders toward the surface of said cam, a rotatable ratchet wheel drivingly connected to said cam member, and a lever and pawl in drive imparting relationship to drive said ratchet wheel.

2. A device of the type set forth in claim 1 wherein the cam riders are rollers and the axis of each of the cam riders and the axis of cam rotation are substantially in parallel alignment, such that forces applied to the cam are counter-balanced across the field area.

No references cited.