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G. J. FILIA

3,204,445

HAND TOOL

Filed April 16, 1963

2 Sheets-Sheet 2

Fig. 3.

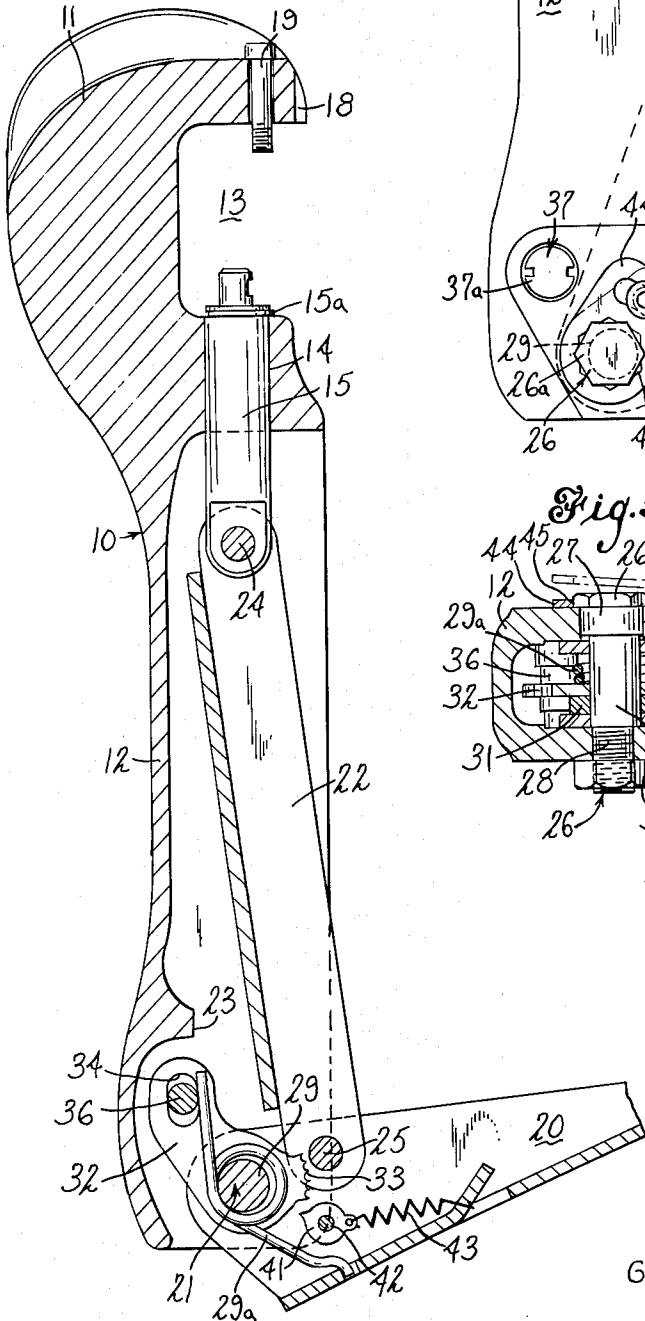


Fig. 4.

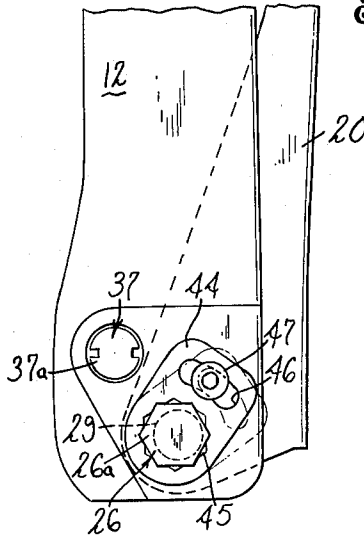


Fig. 5.

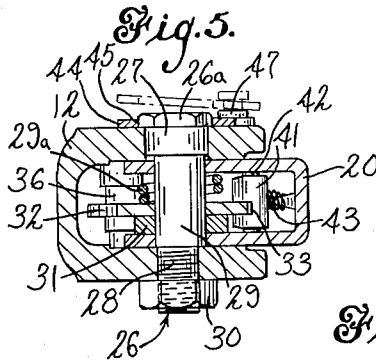
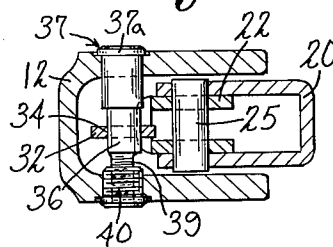


Fig. 6.



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3,204,445
HAND TOOL

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This invention relates to hand tools and relates more particularly to a hand tool of the type which may have two relatively swingable and pivotally interconnected hand-operated elements which are swung relatively to one another to move work-engaging or work-performing parts of the tool.

The work-performing parts of the tool may receive, for example, crimping dies. In crimping tools, it is often highly desirable that the distance of travel of one crimping die in a direction toward the other crimping die be controlled very exactly and be uniform with repeated use of the tool. A high output pressure in a crimping tool, that is, pressure on the work, is also often necessary.

In hand tools of this type many attempts have been made to control the cooperation of relatively movable work-performing parts of the tool. It is not uncommon in tools of this type to employ a motion-compelling mechanism to assure in the operation of the tool, that dies be brought toward one another a sufficient distance to satisfactorily perform the work, such as crimping a terminal to an electrical conductor, before the dies may be separated. It is well known that in crimping terminals to an electrical conductor it is necessary to achieve not only a strong physical connection between the parts, but also a good electrical connection.

While motion-compelling mechanisms have been used advantageously in hand tools, they have not alone provided the answer to the aforementioned problem, namely, the control of the cooperation between relatively movable work-engaging parts such as crimping dies. To at least attempt to solve the problem, parts of such tools, such as crimping dies as well as other parts, have been made to exceedingly fine tolerances. This, of course, increases the costs of these tools, which is objectionable to consumers.

One object of this invention is to provide an improved hand tool having means to adjust relatively movable work-performing parts of the tool.

A further object is to provide in such a tool a new and improved motion-compelling mechanism.

Another object is to provide in a tool such as characterized above, a further adjusting means which cooperates with the motion-compelling mechanism to control the cooperation of the relatively movable work-performing elements of the tool.

The novel features of the invention are particularly pointed out and distinctly claimed in the claims appended to and forming part of this specification. However, the invention, both as to organization and operation, together with further objects and advantages thereof may best be appreciated by reference to the following detailed description taken in conjunction with the drawings wherein:

FIG. 1 is a top plan view of a hand tool embodying the invention;

FIG. 2 is a sectional view taken on line 2-2 of FIG. 1;

FIG. 3 is a view similar to FIG. 2, certain parts being omitted and other parts of the tool being shown in different positions;

FIG. 4 is a view looking in the direction of the arrows 4-4 of FIG. 1;

FIG. 5 is a sectional view taken on line 5-5 of FIG. 2; and

FIG. 6 is a sectional view taken on line 6-6 of FIG. 2.

In the drawings the body of the tool is indicated gen-

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erally at 10, the body having a yoke-shaped head portion 11, an elongated handle portion 12, in fixed relation thereto, and a recess 13 defined in the head which defines opposite arms of the yoke. The aforementioned body may be formed conveniently as a casting.

In head 11 there is provided a bore 14 extending generally lengthwise of the handle portion 12 of the body and extending through one arm of the yoke-shaped head 11 to the recess in handle 12 as best shown in FIG. 2. This bore receives a plunger 15 for lengthwise sliding movement therein. The plunger may be provided with a stop collar 15a fixed thereto cooperating with head 11 to limit movement of plunger 15.

As shown in FIG. 2, one end of plunger 15 has secured thereto, as by any suitable means, a work-performing part of a tool such as a crimping die, indicated in broken line at 16. Die 16 is illustrated as cooperating with a die 17 suitably fixed to the other arm of the yoke-shaped head 11, and may extend into a die-locating keyway 18 and be secured to head 11 by means such as a bolt 19.

The tool has a handle 20 which may be of inverted channel shape throughout at least a major portion of its length. It will be noted that handle 20 is provided adjacent the lower end of handle 12 instead of at a location adjacent the upper end thereof, as viewed in FIG. 2, the pivotal connection between the handles being generally indicated as a pin or bolt 21. This type of construction is known as a reverse handle arrangement. The construction of this pivotal connection will be described in detail hereinafter.

Handle 20 and plunger 15 are pivotally interconnected by a rod 22 which is generally of channel shape. Movement of the rod in one direction may be limited by a stop, shown as an upward projection 23 of the body 10 within the recessed handle 12, and engageable with the bottom of the channel-shaped rod 22. Rod 22 is pivoted to the plunger as at 24 and to the handle 20, as at 25.

The aforementioned pivot 21 interconnecting the handle 20 and the handle 12 (FIG. 5) comprises a bolt 26 having a polygonal head 26a, and immediately adjacent and concentric thereto a cylindrical portion 27, which journals the bolt in one wall of handle 12. The other end portion of the bolt is also concentrically arranged with respect to head 26a and portion 27 and is threaded as at 28. Disposed between the concentric portions 27 and 28 of the bolt is a smooth eccentric cylindrical portion of the bolt having a longitudinal axis offset with respect to the axis of the bolt, the eccentric portion of the bolt being indicated at 29. The eccentric portion 29 of the bolt fits through and within aligned round holes provided in the side walls of handle 20, the dimensions of the holes being such that, while handle 20 may rotate about the axis of the eccentric portion 29, there is a minimum of play between the parts, that is, handle 20 and portion 29.

Cylindrical portion 27 of bolt 26 is received in a hole provided in one side wall of the channel forming the handle 12. The threaded portion 28 of bolt 26 extends through an aligned hole in the other side wall of the channel provided by the handle 12, and exteriorly of the last-mentioned handle threadedly receives a nut 30. It will be obvious from the foregoing that when bolt 26 is angularly adjusted, this adjustment effects adjustment of the axis of eccentric portion 29 and therefore the pivotal axis of handle 20, provided by the eccentric portion 29. Angular adjustment of bolt 26 effects movement of the pivotal axis of handle 20 toward and away from head 11, and thereby adjusts the stroke of plunger 15. Adjustment of the pivotal axis of handle 20 adjusts the effective length of rod 22.

In the illustrated form of the tool, and as best shown in FIG. 5, a spacer 31 is provided on the eccentric portion of the bolt. Immediately adjacent spacer 31 is a bell-

crank lever 32 having an intermediate portion thereof also pivoted on eccentric portion 29 of bolt 26. One end of bell-crank lever 32 is provided with preferably uniform ratchet teeth 33 which are preferably exceedingly fine, and formed on a radius. The other end of bell-crank lever 32 is provided with an elongated slot 34.

A bolt 37 similar to bolt 26 extends through slot 34, the portion of bolt 37 extending through slot 34 being a smooth eccentric cylindrical portion indicated at 36. Bolt 37 has a head 37a provided with means by which the bolt may be turned by a suitable tool. The end of the bolt remote from head 37a is threaded as at 39 and a nut 40, having a head similar to bolt head 37a, extends into the other side wall provided by channel shaped handle 12, and threadedly receives the threaded portion 39 of bolt 37.

It will be manifest from the foregoing that when bolt 37 is angularly adjusted, the eccentric portion 36 thereof adjusts lever 32 angularly to allow infinite change in the angular position of the ratchet with respect to the axis of eccentric portion 29 of bolt 26. It will also appear from the foregoing that the pivotal axis of handle 20 may be adjusted without materially affecting the angular adjustment of lever 32, on which the ratchet is provided, since lever 32 may slide to a limited extent on bolt 37 due to the provision of slot 34 in lever 32.

Ratchet 33 comprises one element of a motion-compelling mechanism. The ratchet cooperates with a pawl 41, pivoted to handle 20 as at 42, and biased by a tension spring 43 of the coil type having its ends suitably connected to the handle 20 and to the pawl 41, respectively.

The handles of the tool, 12 and 20, are urged toward their relatively open positions. For this purpose a coil spring 29a is provided embracing the eccentric portion 29 of bolt 26 and having its ends engaged respectively with handle 20 and bolt 37, as best shown in FIGS. 2 and 3. The operation of the tool will be manifest from the foregoing disclosure. When the handles of the tool are moved from their relatively closed positions, as shown in FIG. 2, to their relatively open position, shown in FIG. 3, plunger 15 carrying its work-performing part is retracted in the head 11 of the body of the tool through the action of rod 22, separating the last mentioned work-performing part from its companion, fixedly mounted on head 11. During this movement, pawl 41 engages ratchet 33 and, due to this engagement, the handles may not be reclosed until they have been opened sufficiently for the pawl to clear the ratchet. It will be understood that when the handles are moved from their positions shown in FIG. 3 to their relatively closed positions (FIG. 2), pawl 41 reengages ratchet 33 and the handles of the tool may not be opened again until they have closed to an extent sufficient to permit the pawl to clear the ratchet.

The pawl and ratchet, which constitute a motion-compelling mechanism, insure that the two work-performing elements such as dies 16 and 17 approach one another to an extent necessary to complete the work performed on the workpiece operated upon by the tool and thereby increase the efficiency of the tool. This arrangement makes the performance of the tool more accurate and in some instances, by way of example, enable dies of somewhat different dimensions to be employed in the same tool, and also allows compensation for wear of parts of the tool. It also enables very fine adjustment of the tool at the factory prior to shipment thereof, and further permits adjustment of the tool in the field.

The motion-compelling mechanism is adjusted merely by loosening nut 40 and angularly adjusting the bolt with which it cooperates, by engaging and turning the head of bolt 37 with a suitable tool. The bolt may be held in an angularly adjusted position by merely effecting retightening of nut 40. Turning of bolt 37 causes cylindrical portion 36 thereof to exert a turning moment on the walls of slot 34 and thereby adjust the position of ratchet 33 with respect to pawl 41. This arrangement provides adjustment of the compelled movement of plunger 15.

The adjustment of the pivotal connection 21 between the handles of the tool which controls the throw of plunger 15, cooperates with the motion-compelling mechanism not only in effect, but physically to give a very close degree of control of the action of the relatively movable work-performing elements of the tool.

To facilitate the turning of bolt 26 providing pivot 21, which is in effect a pin adjustably pivoting the handle 20, there is provided what may be viewed, in at least one aspect, a socket wrench element 44 adjustably supported and locked with reference to the handle 12 from the tool and coaxing with means to limit the amplitude of its swinging movement. This element, best shown in FIG. 4, comprises a wrench-like plate indicated at 44. This plate has an opening 45 therein to receive head 26a of bolt 26. Formed on a radius from this opening is an arcuate slot 46. A headed bolt 47 extends through slot 46 and is threaded into the near side wall of handle 12. Bolt 47 serves to clamp wrench-like part 44 in a desired angular position and also serves as an abutment to limit the amplitude of angular movement thereof.

The head of the bolt or pin which provides a pivot for handle 20 is of polygonal shape and in the illustrated form is hexagonal. In the illustrated form, the socket in the wrench-like part 44, receiving head 26a of bolt 26, has twice as many faces for a purpose which will appear hereinafter.

To angularly adjust bolt 26, nut 30 is first loosened. Then clamping bolt 47 is loosened. As illustrated, the ends of arcuate slot 46 subtend an angle of 30° from the axis of bolt 37. If bolt 26, providing pivot 21 is to be given somewhat less than a predetermined fraction of a turn (one twenty-fourth, as illustrated), movement of bolt 26 may be effected merely by swinging wrench-like part 44 in the desired direction. However, if bolt 26 is to be given a twenty-fourth of a turn or greater in either direction, head 26a of bolt 26 must be disengaged from the socket formed by the wrench-like part 44, turned to the proper angular position, and then reset in the socket in the part 44. The reason for this is that wrench-like part 44 is preferably constructed as a small part and slot 46, defined therein, has only a short arcuate length. The combination of the short slot 46 with a socket having at least double the number of faces of the head of bolt 26 makes it possible to achieve infinite adjustment of bolt 26 and thereby obtain infinite adjustment of the eccentric portion 29 which provides the pivotal axis for handle 20. When bolt 26 has been adjusted to the desired angular position, bolt 47 and nut 30 may be retightened to very firmly secure the bolt in the desired position. If desired, handle 12 and wrench-like part 44 receiving bolt head 26a may be provided with cooperating indicia to indicate the angular position of wrench-like part 44.

It will be manifest from the foregoing disclosure that there is provided an improved hand tool having means to accurately control relatively movable work-performing parts of the tool, that the means includes a motion-compelling mechanism and includes a further adjusting means which cooperates with the motion-compelling mechanism to control the operation of the relatively movable work-performing elements of the tool. It will be further apparent that the tool may be constructed to give extremely accurate performance at a relatively low manufacturing cost. In this connection, it should be further noted that it is constructed of relatively few parts requiring very fine tolerances, and that the parts are few in number and comparatively rugged.

While only one form of the hand tool has been illustrated in the drawings, it will be apparent to those versed in the art that the tool may take other forms and is susceptible to various changes in details without departing from the principles of the invention and the scope of the appended claims.

What is claimed is:

1. In a hand tool, the combination of an elongated

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body providing a handle portion at one end thereof and having in fixed relation to the other end thereof a head portion having a work-engaging part, a plunger mounted for sliding movement in the body toward and away from said head portion in a direction lengthwise of the body and having a work-engaging part, a handle pivoted to the body at the end portion thereof remote from the head portion and having an end approaching said head portion, a rod pivotally interconnecting the plunger and said handle whereby relative motion of said handle and handle portion toward and away from each other produces reciprocating motion of the plunger, means for adjusting the pivotal connection of the handle to the handle portion to vary the magnitude of travel of the plunger, said means including a pivot-providing member having a longitudinal axis carried by the body, said pivot-providing member having a cylindrical portion thereon eccentric to said longitudinal axis, said eccentric cylindrical portion providing the pivotal axis of said handle, the handle being pivotally mounted about said eccentric portion, said pivot-providing member being adjustably rotatable about said longitudinal axis to produce rotation of the pivotal axis of the said handle to vary the travel of the plunger, coacting motion-compelling means on said body and said handle for said handle and said handle portion controlling relative movements therebetween, the coacting motion-compelling means coacting with said pivot-providing member and being adjustable on adjustment of the pivot-providing member.

2. In a hand tool as defined in claim 1, means mounted on the body and coacting with said pivot-providing member to releasably lock the latter to the body to prevent undesired rotation of the last-named member.

3. A hand tool as defined in claim 2 wherein wrench means is provided for releasably locking said pivot-pro-

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viding member to the body to prevent undesired rotation of said member.

4. A hand tool as defined in claim 3 wherein said wrench member is provided with an arcuate slot spaced radially from the axis of the pivot-providing member, said slot having securing means extending therethrough into the body for limiting movement of said wrench member.

5. A hand tool as defined in claim 4 wherein said handle portion is of channel form and receives therein said rod when the latter is in stored position, the latter also being of channel form and said handle being at least partially of channel form and receiving, when in closed position, at least part of said handle portion and said rod.

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35 WILLIAM FELDMAN, *Primary Examiner.*

**UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION**

Patent No. 3,204,445

September 7, 1965

George J. Filia

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 45, for "is possible" read -- it possible --; column 6, line 24, for "1,741,007" read -- 1,741,077 --.

Signed and sealed this 9th day of August 1966.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents