

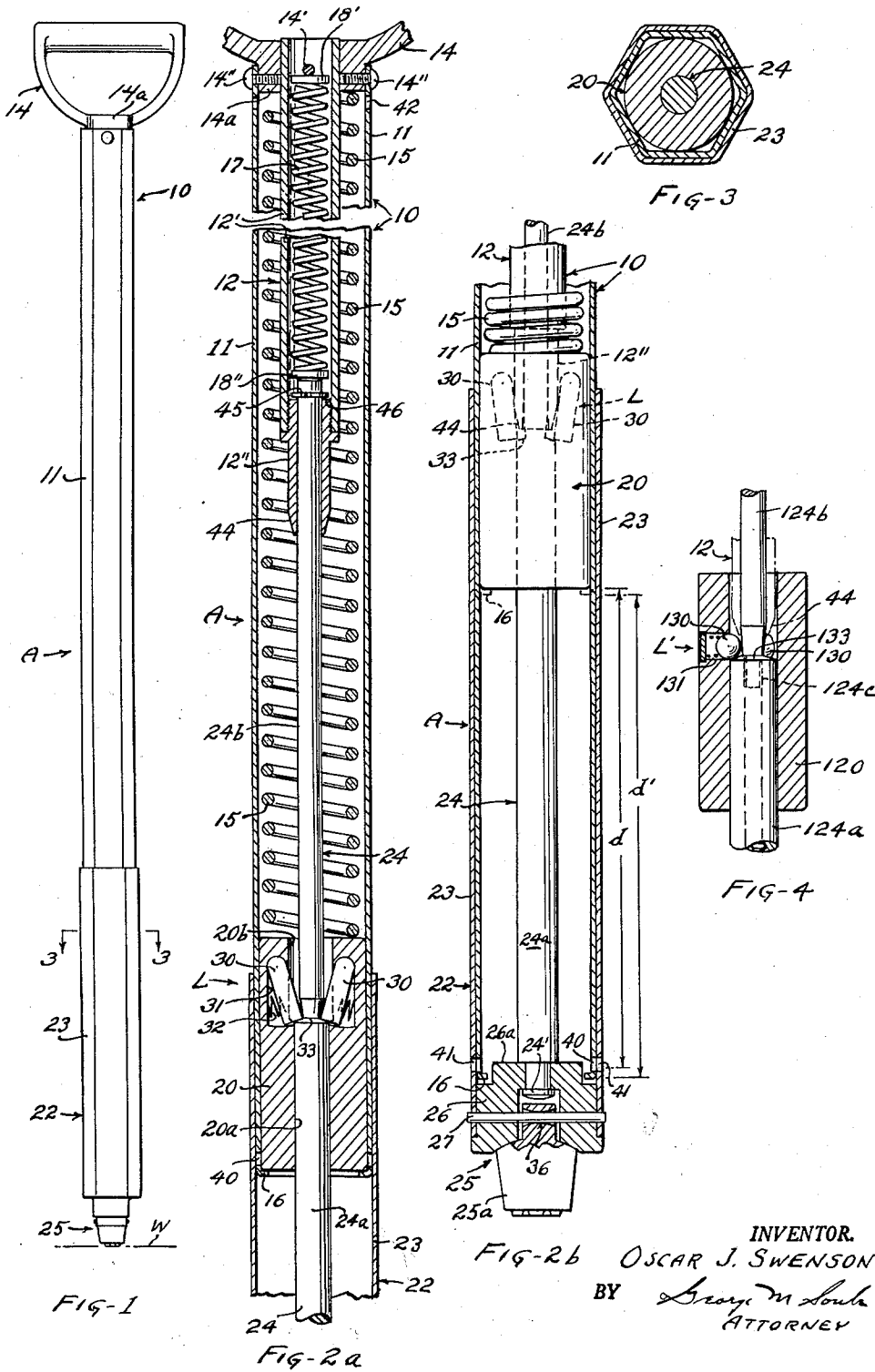
Jan. 8, 1963

O. J. SWENSON

3,071,994

MANUALLY ACTUATED LINEAR ACTION IMPACT TOOL

Filed May 29, 1961



INVENTOR.
OSCAR J. SWENSON
BY *George M. Louie*
ATTORNEY

1

3,071,994 MANUALLY ACTUATED LINEAR ACTION IMPACT TOOL

Oscar J. Swenson, Sunset Hill Drive, Branford, Conn.
Filed May 29, 1961, Ser. No. 113,263
8 Claims. (Cl. 81—52.35)

This invention relates to an improved manually actuated spring operated impact tool or hammer for performing punching operations, driving fasteners such as nails and performing other linear impact operations, that is to say operations along a straight line in the direction of impact stroke as against operations involving application of torque.

Manually actuated impact tools (e.g., prick punches, center marking tools, etc.) are well known wherein a hammer mounted for movement longitudinally of a tubular handle unit is retained in a normal or inactive condition or position by a latch while a predetermined amount of energy is being stored by manual operation in a power spring connected or arranged to cause the hammer to deliver a blow. At the termination of the energy storing manual operation the latch is automatically released; the blow is struck by the hammer, and then, preparatory to performance of another above outlined energy storing operation, the hammer is automatically restored to and relatched in its said normal or inactive condition or position by suitable return spring means.

Performance of the above outlined operations has heretofore involved rather expensive, high precision machining and difficult assembling operations; and the work capacity for delivery of impacts—particularly length of stroke—has been limited to light duty service. Increase of work capacity for heavy duty operations by proportional scale enlargement of the known devices would, usually at least, so greatly increase mass as to make the devices impracticable for operation as portable, manually actuated tools.

The present tool can be made of simple, sturdy construction at relatively low manufacturing cost and be capable of long stroke, heavy duty operation to deliver impacts or hammer blows the effective force of which need be limited only by the physical strength of the user. One feature enabling, inter alia, concurrent attainment of long stroke powerful impact operation with generally light weight and low cost construction is an unique employment of continuously producible (i.e., uniform wall thickness) tubing as main frame or casing components, complemented by inexpensively produced, as automatically machinable, members and so called "standard" parts such as screws.

Objects of the invention not indicated above will become apparent from the following description of a typical construction as shown in the accompanying drawing, wherein:

FIG. 1 is a small scale side view of the present tool with its principal components in normal or inactive fully extended position.

FIGS. 2a and 2b are enlarged fragmentary mutually complementary central sectional assembly views of respective portions of the tool. FIG. 2a shows the power spring and hammer in initial or inactive condition. FIG. 2b shows a portion of the power spring and the hammer just before a blow is struck by the hammer.

FIG. 3 is a cross sectional detail view taken along the line 3—3 on FIG. 1.

FIG. 4 is a fragmentary longitudinal sectional view showing a modified latch mechanism.

The present tool A, solely for convenience, will be described and discussed as though positioned vertically in use. Typical use is simultaneously to indent a plurality of letter or numeral character dies into metal objects such as billets in a mill. For such use the tool A as shown in

2

FIG. 1 (i.e., extended to maximum length) would be waist high to an average workman and be designed for stroke length in the magnitude of eight or more inches.

The tool as shown by comparison of FIGS. 1, 2a and 2b, comprises a unitary head or handle assembly or input unit 10 comprising, as shown, a main outer tube or sleeve 11, an inner tube or sleeve assembly 12 (tube 12' and tubular fitting 12''), and an interconnecting, D-type handle or head member 14. Associated end portions of the tubes 11 and 12' can be rigidly joined coaxially of each other via shank 14a of the handle member 14 through suitable fasteners such as a cross pin 14' and screws 14'', FIG. 2a.

Outer tube 11 of input unit 10 contains and guides an elongated main or power coil compression spring 15 bearing (desirably with considerable initial preloading) at its upper end against the head construction (e.g. the shank of the handle member 14) and at its opposite or lower end against a tubular hammer or inertia member 20. The hammer 20 occupies the latched (initial) position in the tube 11 shown in FIG. 2a, as will be more fully explained, during cocking of the power spring 15; and, prior to cocking, the preloading of the power spring holds the lower end of the hammer snugly against an intumed flange 16 at the bottom of tube 11. The flange 16, after performance of impact, is instrumental in returning the hammer to its initial position as will be explained.

The inner tube or sleeve assembly 12, as shown in FIG. 2a, contains a relatively low scale coil spring 17, hereinafter identified as the position restoring or return spring for the input and output units 10 and 22 of the tool. The spring 17 has a supporting or reactance connection with the head construction of the input unit 10 shown as comprising a metal disk 18' held by the spring 17 against the cross pin 14', and the opposite or lower end of the spring 17 bears downwardly against part of an operatively integral output (anvil) unit 22 to be described below.

The anvil-constituting or output unit 22 (FIG. 2b) comprises as shown a tube or sleeve 23 forming a casing or outer body portion of unit 22 around and slidably telescoping the tube 11 of input unit 10, and an elongated metal rod or bar 24 extending through the tube 23 and into the tube 11 and tube assembly 12 coaxially therewith. The rod 24 is suitably made operatively rigid or integral with the tube 23 via, for example, a hardened metal anvil block 26, FIG. 2b, forming part of an anvil assembly 25 and which in the operation of the tool is struck by the hammer 20. As shown, the rod 24 is riveted to the anvil block at 24', and the anvil block is secured to the tube 23 by a pin 27. The slidably telescoping tubes 11 and 23 of units 10 and 22 as in the vicinity of the hammer 20 in its normal or inactive position, are overlapped as much as necessary in order to maintain substantial alignment of the components, hence axial freedom of operation.

The rod or bar 24 is of stepped diameter cylindrical construction as shown, having a relatively large diameter base or foot portion 24a within the tube 23, extending freely, i.e., slidably through an axial bore 20a of the hammer and having a smaller diameter shank portion 24b thereabove extending through a counterbore 20b of the hammer and slidably into the axial bore of fitting 12'' of the restoring spring tube assembly 12.

Within the tube assembly 12 the upper end of the shank portion 24b of rod 24 operatively abuts the lower free end of the restoring spring 17 via a metal disk 18'' loosely occupying tube member 12', so that, between impact operations, the input unit 10 is in effect actively lifted, by expansion of the spring 17, a limited distance relative to the output unit 22 to restore the units to normal position. The restoring operation requires selection of scale and length of spring 17 adequate to overcome forces resulting from weight of components and friction in moving the input

unit 10 and output unit 22 with respect to one another in reestablishing their initial relative positions. The reason the power spring 15, in its inactive or initial condition, has considerable axial preloading is in order that the total variation in force exerted by the spring during operation to cock it will not be a high percentage of the ultimate loading of the spring.

The normal maximum or extended length of the tool A, as in FIG. 1, or the distance the input and output units 10 and 22 thereof can separate from each other axially is established, as shown in FIG. 2a, by an abutment connection comprising a snapping 45 mounted on the upper end portion 24b of rod 24 for abutment with an axial shoulder 46 on the fitting 12' of the tube assembly 12, and by an opposing abutment connection comprising contact between the hammer 20 and the flange 16. Thus the restoring spring 17 opposes but allows axial collapse of the tool such as results from power-spring-compressing movement of the handle 14 toward anvil assembly 25 when the latter is resting against the work W, FIG. 1. During the energy-storing movement the hammer 20 is restrained from being moved downwardly by the power spring 15 or toward the anvil assembly 25 by a releasable latch device, generally designated L FIGS. 2a and 2b. The latch L as shown in FIG. 2a has one or more pawls 30 in respective recesses 31 of the hammer and biased by suitable springs 32 toward the axis of the rod 24 for latching engagement with an upwardly facing shoulder 33 on the rod.

Downward movement of the input unit assembly 10 to compress the power spring 15 causes the flange 16 of associated tube 11 to move downwardly away from the latch-restrained hammer 20 until the flange 16, as shown in FIG. 2b, is below the top side or surface 26a of anvil block 26, so that the hammer, when released, can strike the anvil surface 26a but cannot strike the flange 16 and damage it.

To release the latch device L at the proper time the lower tapered end of the fitting 12' of tube assembly 12 constitutes a cam 44 rigid with unit 10 and which, after the flange 16 is below the striking surface 26a of the anvil assembly (see lower part of FIG. 2b), forces the pawls 30 out of latching contact with the latching shoulder 33 on the rod 24. The power spring 15 then propels the hammer forcibly against the anvil face 26a.

The work-engaging or striking piece 25a (type die for example) preferably has a suitable limited swivel joint connection 36 with the anvil block 26 (e.g., at pivot pin 27, FIG. 2b) to permit equalized pressure of the character dies against the work despite displacement of the longitudinal axis of the tool A somewhat out of normal position relative to the face of the work to be indented. The pivot pin 27 may serve detachably to connect the anvil block 26 rigidly to the tube 23 of unit 22.

In the illustrated arrangement according to FIG. 2b the hammer stroke (distance d , FIG. 2b) is by design sufficiently less than the distance d' traversed by the flange 16 of the tube 23 during cocking of the power spring 15 so that the anvil assembly 25 can have whatever movement is necessary in order (e.g.) to indent the work to the desired depth but, again, without allowing the lower face of the hammer to strike the flange 16. If a greater effective stroke during impact is desired (as for driving a nail fed from a suitable magazine—neither shown—with one stroke of the hammer) then the difference between distances d and d' is appropriately increased and the latching shoulder 33 on the rod 24 would then be located a correspondingly less distance from face 26a of the anvil than as shown.

Tubes 11 and 23 of units 10 and 22 can economically be made of continuously producible respectively uniform thickness light gage metal tube stock, and as shown by comparison of FIGS. 2a and 2b, the only significant operation necessary to be performed on either of the tubes 11 and 23 is the formation of flange 16 on the former. If

the tubes 11 and 23 are of non-circular cross section, e.g., hexagonal or square, the anvil assembly 25 is assured of remaining oriented angularly with the handle 14 during operation of the tool. In case the hammer 20 matingly substantially fits the tube or sleeve 11 of input unit 10 (e.g., both hexagonal) so that, by piston action, the hammer tends to be impeded by trapped air during its impact stroke, then freedom of hammer movement as the compressed power spring 15 expands can be assured by provision of air vents as at 40 and 41 in the respective tubes 11 and 23. The vents are designed so as to come into alignment (FIG. 2b) just before the hammer 20 is released and can economically be assured of full registration if the tubes are matingly non-circular in cross section as already mentioned. If necessary the space enclosed by unit 10 above the hammer 20 can be vented as by holes 42 (top, FIG. 2a).

If the rod 24 is of one-piece construction as shown in FIG. 2a the threaded fitting 12' of the restoring spring tube assembly 12 enables the snap ring 45 to be secured easily to the upper end of the rod 24 during assembly of the tool despite the fact that the distance between the nose of the cam 44 on fitting 12' and the shoulder 33 on the larger diameter portion 24a of the rod 24 is considerably less than the distance between the top end of the rod and the top of the tube member 12'. If tube members 12' and 12'' were to be made in one piece, then the rod shoulder 33 would prevent movement of the upper end of the rod 24 upwardly beyond the top of the tube 12' to expose the groove which accommodates the snap ring 45.

In order to provide cavities 31 in the hammer 20 for the pawls 30 the technique disclosed by my prior application Ser. No. 64,119 filed October 21, 1960, entitled Rotary Impact Wrench is preferably followed. In such case the cavities 31 are holes of uniform contour ("through" holes) shaped generally like the pawls at their two effective ends so that the pawls are free to swing pivotally while being retained in their cavities, and without having to provide special pivot pins for the pawls.

In an alternate form of latch mechanism L' (FIG. 4), one or more spring biased spherical latch members 130 (e.g. bearing balls) movable freely in radial holes 131 of hammer 120 replace the latch pawls 30. In such case a hardened tube 124a complemented by a separate upper rod member 124b threaded thereto as at 124c can carry the latching shoulder 133. The rest of the hammer assembly and its operation would be exactly as already described except that the threaded connection at 124c could permit a head, not shown, integral with the top end of rod 124b to serve in place of snap ring 45 of FIG. 2a to limit the extension of the units 10 and 22 by action of the return or restoring spring assembly.

I claim:

1. In a manually actuated, spring operated, linear action impact tool, an input unit including a tube having a head portion and a free end portion, an output unit including an anvil block beyond said free end portion in a direction away from the head portion and having an impact-receiving face, a rod connected with the block and extending toward the head portion within the tube, coaxing axial shoulders rigid with the rod and head portion respectively within the tube for limiting axial movement of said units away from each other, the rod having a latching shoulder between its ends facing the head portion, a hammer within the tube and movable along the rod and tube so as to strike the anvil block, a helical compression spring in the tube operatively bearing at one end on the hammer and at its other end on the head portion, a latch movably carried by the hammer releasably to engage the latching shoulder, means rigid with the head portion arranged to release the latch as a function of predetermined movement of said units toward each other, an abutment on the free end portion of the tube positioned axially adjacent an opposing surface of the hammer in the

5

latched position of the hammer and positionable beyond said impact receiving face, so as not to be struck by the hammer, as a function of movement of said units toward each other to compress the spring and release the latch.

2. The tool according to claim 1 wherein said abutment of said tube is a flange thereon underhanging the hammer when the tool is disposed in an upright position.

3. The tool according to claim 1 including a tube rigid with the anvil block matingly telescoping said tube of the input unit.

4. The tool according to claim 3 wherein the mating tubes are of non-circular cross section preventing angular displacement of the anvil block relative to the input unit.

5. The tool according to claim 4 wherein the hammer slidably fits the tube of the input unit so as to act as a piston therein, and the tubes have vent openings in their walls which are brought into registration as a function of movement of the units into position to release the latch.

6. The tool according to claim 1 wherein the latch includes an inwardly spring biased pawl pivotally supported in a transversely extending recess of the hammer for engagement with said latching shoulder of the rod.

7. The tool according to claim 1 wherein the latch includes a member movable in a radial bore of the hammer and spring biased inwardly of the axis of the rod to latching position.

8. In a manually actuated, spring operated, linear action impact tool, an input unit including inner and outer tubes interconnected at adjacent ends of the tubes to form a head portion of the input unit, an output unit

6

coaxial with the input unit and including an anvil block remotely of said head portion and a rod extending therefrom toward the head portion and entering the inner tube, coaxing axial shoulders on the rod and inner tube respectively disposed for limiting axial movement of said units away from each other, the rod having a latching shoulder between its ends facing the head portion, a hammer guided for movement along the rod in position to strike the anvil, a helical compression power spring in the outer tube operatively bearing at one end on the hammer and reactively supported by said head portion, a latch movably carried by the hammer releasably to engage the latching shoulder, means on the inner tube arranged to release the latch as a function of predetermined movement of said units toward each other, an axial shoulder on the outer tube adjacent the hammer in the latched position of the hammer, and a restoring spring in the inner tube opposing movement of the rod and said head portion toward each other, thereby enabling the outer tube, via its said shoulder, to return the hammer to latched position after striking the anvil.

References Cited in the file of this patent

UNITED STATES PATENTS

1,720,318	Chisolm	July 9, 1929
2,098,495	Greenberg	Nov. 9, 1937
2,455,270	Ravella	Nov. 30, 1948
2,594,901	Forster	Apr. 29, 1952

FOREIGN PATENTS

999,148	France	Oct. 3, 1951
---------	--------	--------------