

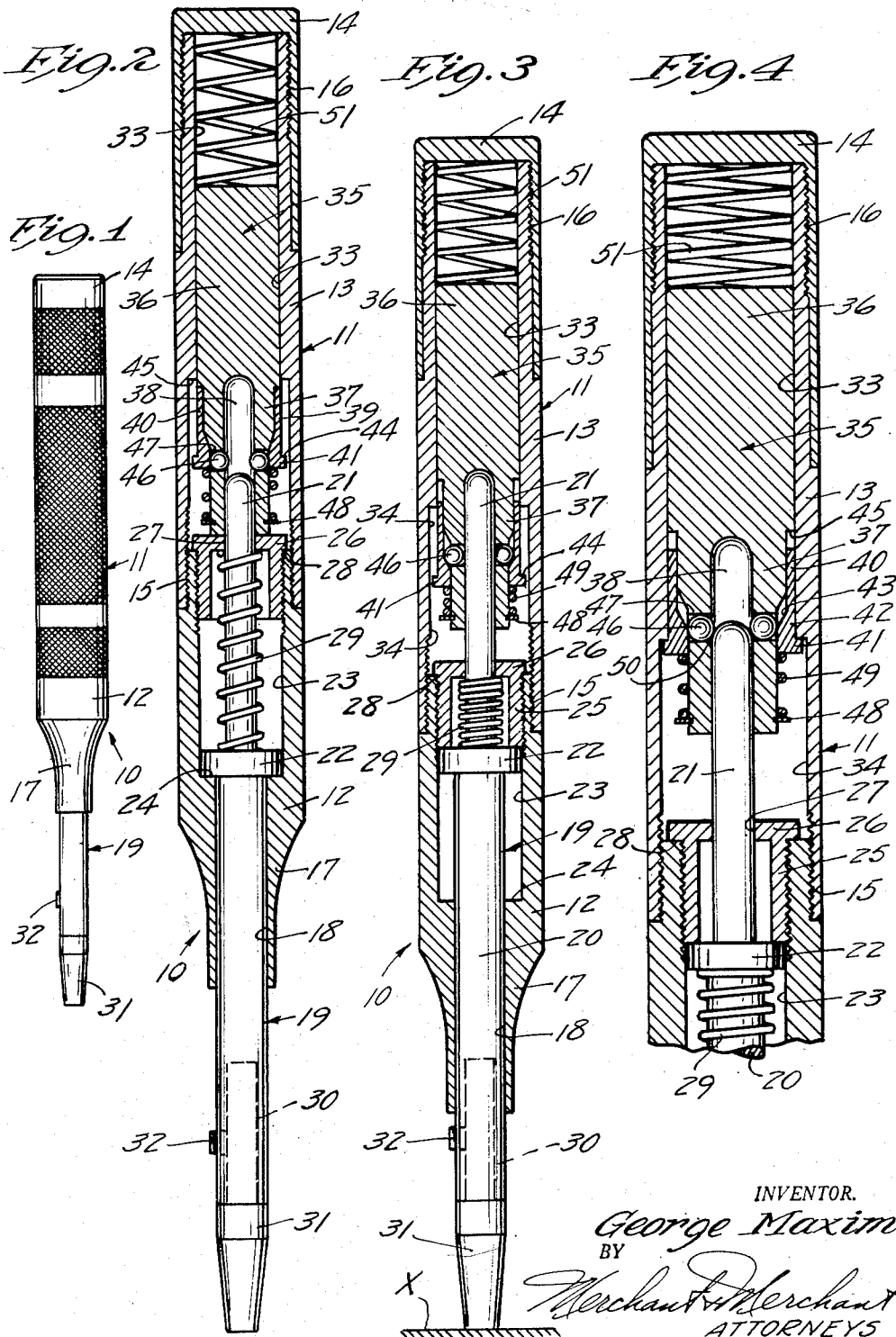
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AXIALLY PROJECTABLE IMPACT TOOL

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AXIALLY PROJECTABLE IMPACT TOOL

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6 Claims. (Cl. 81—52.35)

My invention relates to an impact tool, and in particular it relates to a hand operated automatic impact tool which is particularly adapted for setting rivets.

An object of my invention is to provide a novel and improved impact tool which will deliver a good impact with the least effort, and which is of simple construction yet effectively operative.

Another object of my invention is to provide a novel and improved impact tool having a triggering unit which will withstand large impacts and retain its effectiveness for a long life of use.

Another object of my invention is to provide a novel and improved impact tool having a triggering unit which is simpler, more effective, and more durable than any other impact tool now known to me.

These and other objects and advantages of my invention will become apparent in the course of the following specification and claims, reference being had to the accompanying drawings, wherein:

Fig. 1 is a view in side elevation of my invention;

Fig. 2 is an enlarged view partly in vertical section and partly in elevation of the structure shown in Fig. 1, showing the parts thereof in their normal positions;

Fig. 3 is a view similar to Fig. 2, showing the parts thereof in different positions and at impact; and

Fig. 4 is an enlarged fragmentary view similar to Figs. 2 and 3 showing the parts thereof in different positions and just prior to release of the triggering unit.

Referring now more particularly to the drawings, wherein like parts are indicated by like numerals, my novel and improved impact tool is indicated in its entirety by the general reference numeral 10. Tool 10 comprises a hollow longitudinally extended handle and/or housing member, indicated in its entirety by the numeral 11, which comprises a shaft housing section 12, a hammer housing section 13 and an adjustable cap section 14. Housing sections 12 and 13 are releasably rigidly joined in telescopic screw threaded engagement, as indicated by the numeral 15; and housing section 13 and cap section 14 are telescopically joined in screw-threaded engagement as indicated by the numeral 16, and are longitudinally adjustable with respect to each other for a purpose which will be subsequently brought out. The reduced lower end 17 of housing section 12 is formed with an outwardly opening axial bore 18 to receive and mount shaft or tool member 19. Shaft 19 comprises an impact tool receptacle shaft section 20 and a reduced diameter hardened anvil shaft section 21 which are telescopically integrally joined together by a press fit.

Forming shaft 19 in the two separate sections 20 and 21 requires less machining than if formed in one piece, because anvil shaft section 21 may be easily formed from a standard hardened dowel pin. In case of damage to either of the shaft sections 20 and 21, either or both can be easily replaced.

Shaft 19 is telescopically disposed with respect to handle 11 for limited extending and retracting movements with respect thereto with shaft section 20 slidably mounted

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in bore 18. Shaft section 20 has an enlarged cylindrical flange 22 anchored at its inner end, and preferably integrally formed therewith, which works slidably in an enlarged axial bore 23 of housing section 12 between the shouldered end 24 thereof and a spring retaining sleeve-like plug 25 which is anchored at the inner end of housing section 12, preferably being telescopically screw-threaded into the open end of bore 23. Plug 25 has a closed end 26 with an axial opening 27 formed therein through which projects shaft section 21 for sliding movement with respect thereto. Annular shoulder portion 28 of plug 25 abuts the inner end of housing section 12. I provide yielding resilient means, indicated by the numeral 29, which is a helical compression spring encompassing shaft section 21 and disposed between closed end 26 of plug 25 and flange 22. Yielding resilient means or compression spring 29 biases shaft 19 to its maximum extended position, which is its normal position, wherein flange 22 abuts the closed outer end 24 of axial bore 23. Sleeve-like plug 25 acts to retain compression spring 29 in position.

Shaft section 20 at its outer end is provided with an axially extended outwardly opening recess 30 which is adapted to receive the stem of an impact tool head 31, which is anchored in position by a set screw 32. Impact tool head 31, as particularly shown, is adapted for setting a rivet; but it is clear that my impact tool 10 is adapted for a plurality of interchangeable tool heads for performing different functions, such as punching, gouging, and the like.

Hammer housing section 13 has an axial bore extending therethrough which comprises a reduced bore portion 33 and an enlarged bore portion 34. I provide a hammer 35 slidably mounted in housing section 13 in axially aligned relationship with shaft 19. Hammer 35 is a generally cylindrical member of varying diameters and comprises an enlarged rearward end portion 36, which is slidably mounted in reduced bore portion 33, and a reduced end portion 37, which projects into enlarged bore portion 34. Hammer 35 has formed in the reduced end portion 37 thereof, which is disposed adjacent shaft 19, an axially extended outwardly opening recess 38 which is adapted to slidably receive the inner end of shaft section 21. Mounted on the reduced recessed end 37 of hammer 35 is a bushing 39, which is bored to define a rearward skirt portion 40, a forward head portion 41, and an intermediate portion 42 which defines an intermediate internal tapered cam surface 43. Skirt portion 40 of bushing 39 is slidably mounted on an enlarged part of reduced end portion 37 and head portion 41 is slidably mounted on a reduced part of reduced end portion 37. Reduced end portion 37 mates with bushing 39 with cam surface 43 thereof abutting correspondingly tapered intermediate part of reduced end portion 37 between the enlarged and reduced diameter parts thereof and with the end of skirt portion 40 abutting the shoulder between enlarged portion 36 and reduced portion 37 of hammer 35. Head portion 41 of bushing 39 is formed with a radially outwardly projecting annular shoulder 44 which is of less diameter than enlarged bore portion 34 but of greater diameter than reduced bore portion 33. With the exception of shoulder 44, the outside diameter of bushing 39 is substantially equal to the outside diameter of the enlarged rearward portion 36 of hammer 35 so that bushing 39 is slidable with hammer 35 into reduced bore portion 33, as indicated in Figs. 3 and 4, to the limit permitted by shoulder 44. Shoulder 44 co-operates with a shoulder 45 formed in housing 11 between bores 33 and 34 of housing section 13 in a manner which will be subsequently brought out.

Bushing 39 comprises a control member which is a part of a triggering mechanism that further comprises a plu-

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rality of circumferentially spaced triggering balls 46, which are each mounted in a ball-receiving aperture 47. Apertures 47 are formed in the reduced end portion 37 of hammer 35 intermediate the ends of recess 38 in circumferentially spaced relationship; each of the apertures 47 intersects the recess 38 and extends therefrom to open radially outwardly. The reduced recessed end 37 of hammer 35 extends beyond bushing 39; and adjacent the end thereof, I provide an abutment indicated by the numeral 48, which is preferably a spring steel snap-on retaining ring. I provide yielding resilient means comprising a helical compression spring 49 which encompasses the reduced recessed end 37 of hammer 35 between ring 48 and bushing 39 for biasing bushing 39 to its normal position, as shown in Fig. 2. At the normal position of bushing 39 the head portion 41 thereof adjoins apertures 47 to maintain triggering balls 46 at their normal operative positions wherein they protrude into the recess 38. This is clearly shown in Fig. 2. It should be particularly noted that apertures 47 are slightly restricted by shoulders, indicated by the numeral 50, adjacent the intersection of apertures 47 with recess 38 for limiting radially inward movement of triggering balls 46 and preventing them from dropping into recess 38.

I provide yielding resilient means comprising a compression hammer spring 51 which normally biases hammer 35 toward shaft 19 until the reduced end portion 37 thereof abuts the closed end 26 of plug 25.

The elements of my tool 10 are disposed as shown in Fig. 2 when in their normal at-rest positions. It should be particularly noted that normally the inner end of anvil shaft 21 is disposed in recess 38 outwardly of triggering balls 46. Tool 10 is operatively used to provide an impact for setting a rivet, nail or the like, or for performing other functions such as punching, gouging, and the like. As an example, tool 10 is shown in Fig. 3 being used to deliver an impact to the surface, indicated by the letter X. When tool 10 is operatively used, it is placed on the member to receive the impact, surface X, in a generally vertically disposed upright position. The operator grasps the handle or housing member 11 and applies downward pressure. It should be noted, as shown in Fig. 1, that the exterior surface of handle member 11 is knurled to provide a suitable grip for the operator. Downward pressure on the handle or housing member 11 moves the inner end of anvil shaft section 21 into engagement with triggering balls 46, which are maintained in their normal operative positions by bushing or control member 39, and thereafter moves hammer 35 relatively toward cap section 14 against the bias of hammer spring 51, which acts to compress spring 51. As handle or housing member 11 is moved generally downwardly by the operator toward surface X, shoulder 45 is moved toward shoulder 44. Shoulders 44 and 45 form a pair of cooperating relatively movable abutments, one rigid with bushing 39 and the other rigid with the handle member 11. Further downward pressure by the operator moves shoulder 45 against shoulder 44 which forces bushing 39 to move therewith away from its normal position and relatively forwardly toward the surface X, against the bias of spring 49. When bushing 39 has moved on the reduced end portion 37 of hammer 35 sufficiently downwardly to the position shown in Fig. 4 so that the center line of triggering balls 46 is just beyond the edge of cam surface 43 adjoining head portion 41, the outward thrust of triggering balls 46 against cam surface 43 aids in the relatively downward movement of bushing 39 and thereby suddenly releases triggering balls 46 outwardly from their normal operative positions to their released positions, shown in Fig. 3. The radially outward movement of triggering balls 46 from their normal positions to their released positions permits shaft 19 to move relative to hammer 35 into the recess 38 until the inner end of anvil shaft section 21 is engaged by hammer 35 at the closed end of recess 38. Actually, the sudden release of triggering balls 46 causes

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hammer 35, under the bias of compressed hammer spring 51, to move relatively downwardly and deliver its impact to the inner end of anvil shaft section 21 which is transmitted directly to the impact tool head 31; and of course impact tool head 31 in turn delivers its impact to the surface X. The position of the elements of my tool 10 just after impact is shown in Fig. 3. The amount of impact delivered by tool 10 is adjustable by the adjustment of cap section 14. It is clear that the greater compression of spring 51 at the release of triggering balls 46, the greater will be the impact. Cap section 14 is longitudinally movable relatively outwardly for less compression of spring 51 and relatively inwardly for more compression thereof.

It should be noted that at the normal position of bushing 39, head portion 41 thereof adjoins the outward openings of apertures 47 to prevent radially outward movement of triggering balls 46 from their normal operative positions. However, the movement of bushing 39 on reduced end portion 37 of hammer 35 moves the reduced bored part or head portion 41 of bushing 39 away from apertures 47 and moves the enlarged bored part or skirt portion 40 of bushing 39 toward apertures 47. It is clear that when skirt portion 40 is disposed radially outwardly of apertures 47 that there is an annular space between bushing 39 and the openings of apertures 47 to permit the radially outward movement of triggering balls 46. Skirt portion 40 restrains triggering balls 46 from moving radially outwardly beyond their released positions. Bushing 39 is in its released position when skirt portion 40 is adjacent and radially outwardly of the openings of apertures 47 as shown in Fig. 3.

After impact has been delivered by my tool 10, downward movement of handle or housing member 11 is reversed to an upward movement which movement is of course aided by the compression of spring 29 which acts to bias shaft 19 to its normal maximum extended position with respect to housing 11. It is clear that as long as anvil shaft section 21 is disposed radially inwardly of triggering balls 46, bushing 39 is maintained at its released position; however, when shaft 19 is returned by spring 29 to its normal position, shaft section 21 is moved outwardly beyond triggering balls 46 which will permit the return thereof to their normal operative positions. Thus, when shaft 19 is returned to its normal maximum extended position, spring 49 will return bushing 39 from its released position to its normal position, shown in Fig. 2. During the movement of bushing 39 from its released position to its normal position, cam surface 43 moves triggering balls 46 radially inwardly from their released positions to their normal operative positions, which puts my impact tool, including the triggering unit thereof, into proper position for the next cycle of operation.

My invention has been built and tested and found to accomplish all of the aforementioned objectives and advantages, and to be a highly desirable commercial product. It will be obvious to those skilled in the art that my invention may be modified by many substitutions and equivalents, and that this disclosure is intended to be illustrative only; therefore, I intend to be limited solely by the scope of the appended claims.

What I claim is:

1. An impact tool comprising a hollow longitudinally extended handle, a shaft telescopically disposed with respect to said handle and mounted therein for limited extending and retracting movements with respect thereto, a hammer mounted in said handle in axially aligned relationship with said shaft for longitudinal movements alternately in opposite directions, yielding resilient means for biasing said hammer toward said shaft, said hammer having an axially extended outwardly opening recess formed in the end thereof adjacent said shaft and adapted to receive the inner end of said shaft, said hammer having a ball-receiving aperture formed therein intermediate the ends of said recess which intersects said recess and

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opens laterally outwardly, and a trigger mechanism comprising a triggering ball disposed in said aperture for lateral movement between a normal operative position and a released position, said ball at its normal operative position protruding into said recess and being adapted to engage the inner end of said shaft and prevent further movement thereof into said recess and at its released position permitting said shaft to move relative to said hammer into said recess until the inner end thereof abuts the closed end of said recess, a control member mounted on the recessed end of said hammer for longitudinal movement alternately in opposite directions between a normal position and a released position, said control member at its normal position acting to maintain said ball at its normal operative position and at its released position permitting outward movement of said ball to its released position, resilient yielding means biasing said control member to its normal position, and means for moving said control member from its normal position to its released position.

2. The structure defined in claim 1 in which said last-mentioned means comprises a pair of cooperating relatively movable abutments one rigid with said control member and the other rigid with said handle.

3. An impact tool comprising a hollow longitudinally extended handle, a shaft telescopically disposed with respect to said handle and mounted therein for limited extending and retracting movements with respect thereto, a hammer mounted in said handle in axially aligned relationship with said shaft for longitudinal movements alternately in opposite directions, yielding resilient means for biasing said hammer toward said shaft, said hammer having an axially extended outwardly opening recess formed in the end thereof adjacent said shaft and adapted to receive the inner end of said shaft, said hammer having a ball-receiving aperture formed therein intermediate the ends of said recess which intersects said recess and opens laterally outwardly, and a trigger mechanism comprising a triggering ball disposed in said aperture for lateral movement between a normal operative position and a released position, said ball at its normal operative position protruding into said recess and being adapted to engage the inner end of said shaft and prevent further movement thereof into said recess and at its released position permitting said shaft to move relative to said hammer into said recess until the inner end thereof abuts the closed end of said recess, a bushing mounted on the recessed end of said hammer for longitudinal movement alternately in opposite directions between a normal position and a released position and defining a head portion and a skirt portion and an intermediate internal tapered cam surface, said head portion adjoining said aperture at the normal position of the bushing to maintain said ball at its normal position and said skirt portion being disposed adjacent and laterally outwardly of the lateral opening of said aperture to permit outward movement of said ball to its released position, resilient yielding means biasing said bushing to its normal position, and a pair of cooperating relatively movable abutments one rigid with said bushing and the other rigid with said housing for moving said bushing from its normal position to its released position by the engagement of said abutments.

4. An impact tool comprising a hollow longitudinally extended handle having a closed end and an open end, a shaft telescopically received in the open end of said handle and mounted in said handle for limited extending and retracting axial movements with respect thereto, yielding resilient means biasing said shaft to its normal maximum extended position, a hammer mounted in said handle in axially aligned relationship with said shaft for longitudinal movements alternately in opposite directions, a compression spring between the closed end of said handle and said hammer for biasing said hammer toward said shaft, said hammer having an axially extended

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outwardly opening recess formed in the end thereof adjacent said shaft and adapted to receive the inner end of said shaft, said hammer having a plurality of circumferentially spaced radially outwardly opening ball-receiving apertures formed therein intermediate the ends of said recess and which intersect said recess, and a trigger mechanism comprising a plurality of triggering balls each disposed in a different one of said apertures for radial movement therein between a normal operative position and a released position, said balls at their normal operative positions protruding into said recess and being adapted to engage the inner end of said shaft and prevent further movement thereof into said recess, said balls at their released position permitting said shaft to move relative to said hammer into said recess until the inner end thereof abuts the closed end of said recess, a bushing mounted on the recessed end of said hammer for longitudinal movement alternately in opposite directions between a normal position and a released position and defining a head portion having a reduced bore and a skirt portion having an enlarged bore and an intermediate internal tapered cam surface, said head portion adjoining said apertures at the normal position of the bushing to maintain said balls at their normal positions and said skirt portion being disposed adjacent and radially outwardly from the openings of said apertures to permit radially outward movements of said balls to their released positions, a compression spring encompassing the recessed end of said hammer and disposed between an abutment rigid with said hammer and the forward end of said bushing for biasing said bushing to its normal position wherein said cam surface abuts a correspondingly tapered intermediate portion of said hammer disposed inwardly of said apertures, and a pair of cooperating relatively movable abutments comprising a shoulder integral with said bushing and a shoulder formed in said housing intermediate the ends thereof for moving said bushing from its normal position to its released position by the engagement of said abutments.

5. An impact tool comprising a hollow longitudinally extended handle, a longitudinally extended tool member telescopically disposed with respect to said handle and mounted therein for limited extending and retracting movements with respect thereto, a hammer member mounted in said handle in axially aligned relationship with said tool member for longitudinal movements alternately in opposite directions, yielding resilient means for biasing said hammer member towards said tool member, said hammer member and said tool member being telescopically joined at adjacent ends for relative extending and retracting movements with one thereof defining an axially extending recess opening axially toward and adapted to receive the other member, said one member having a ball receiving aperture formed therein intermediate the ends of said recess which intersects said recess and opens laterally outwardly, a trigger mechanism comprising a triggering ball disposed in said aperture for lateral movement between a normal operative position and a released position, said ball at its normal operative position protruding into said recess and being adapted to engage said other member and maintain said members in extended relationship and at its released position permitting said members to move relatively toward one another and into engagement at the end of the recess in said one member, a control member mounted on the recessed end of said one member for longitudinal movement alternately in opposite directions between a normal position and a released position, said control member at its normal position acting to maintain said ball at its normal operative position and at its released position permitting outward movement of said ball to its released position, resilient yielding means biasing said control member to its normal position, and means for moving said control member from its normal position to its released position.

6. The structure defined in claim 5 in which said last mentioned means comprises a pair of cooperating relatively movable abutments one rigid with said control member and the other rigid with said handle.

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