May 4, 1965 E. SUSSMAN 3,181,626

IMPACT TOOLS

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FIG. 1

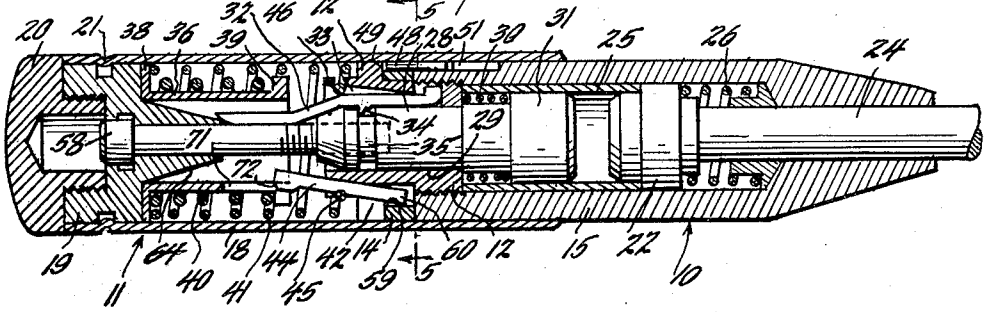


FIG. 2

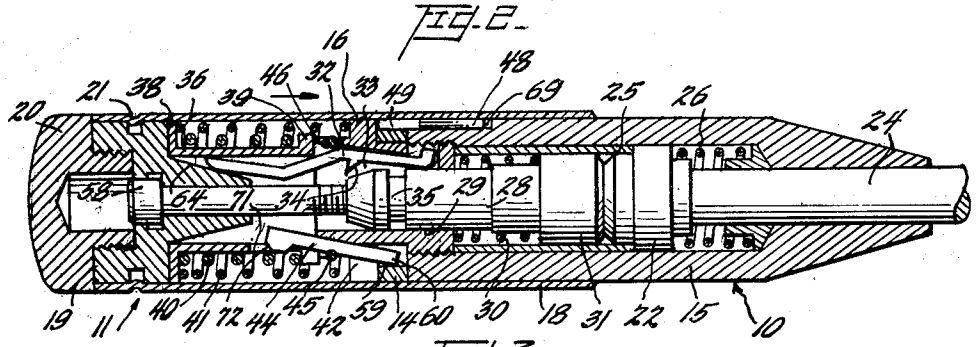


FIG. 3

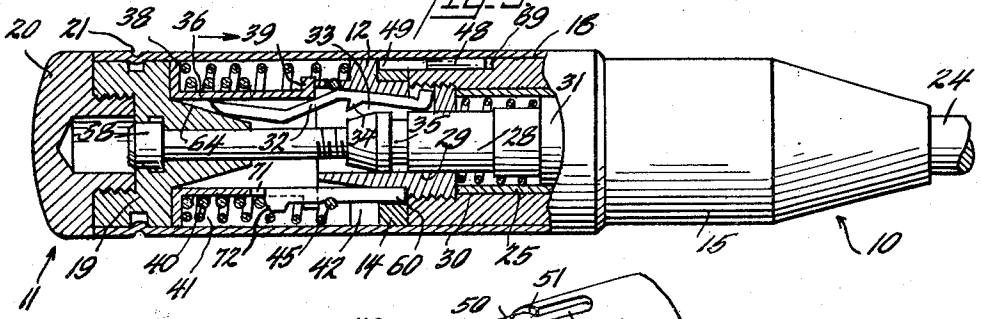
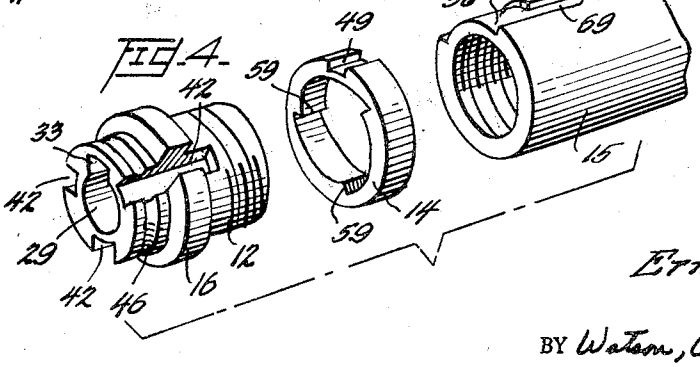


FIG. 4



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FIG. 8.

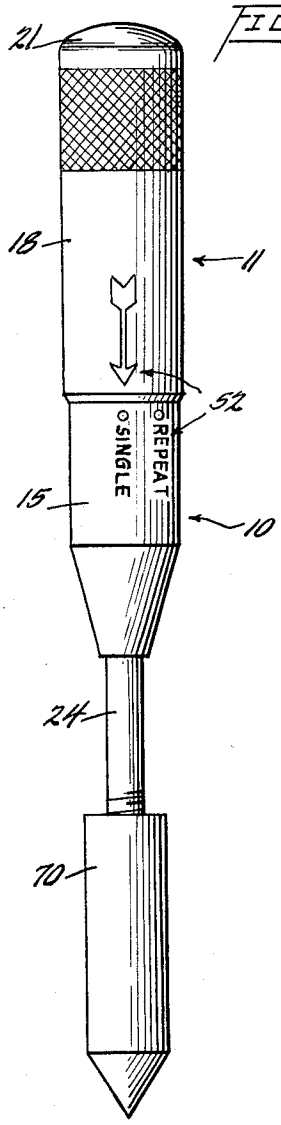


FIG. 9.

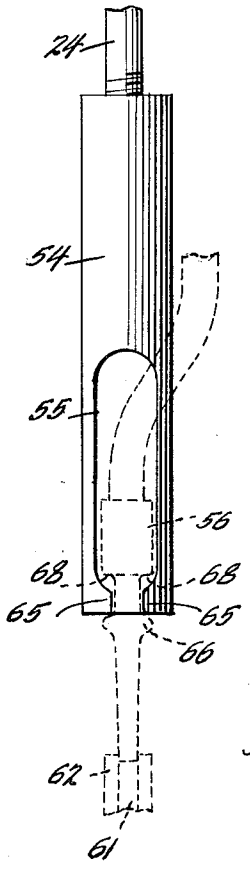


FIG. 5.

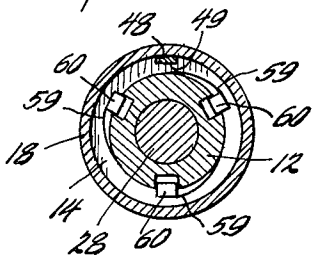


FIG. 6.

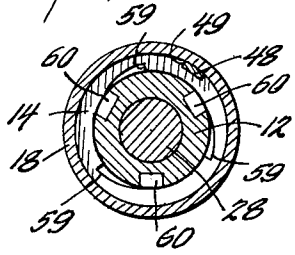
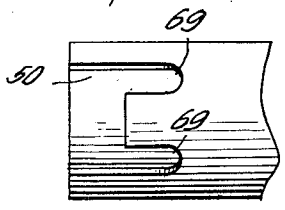


FIG. 7.



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3,181,626

IMPACT TOOLS

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11 Claims. (Cl. 173—53)

This invention relates to impact tools and more particularly to impact tools in which the hammer spring may be cocked prior to application of the tool to a work piece.

Impact tools of various kinds are well-known in the art. These impact tools are all provided with an impact head which forms the working end of the tool. This impact head may be, for example, a conical center punch, an engraving punch, a hollow punch, a nail or staple driver, an electrical pin connector or inserter, or any other type of elementary tool adapted to function under the action of a sharp impact. The known impact tools referred to above generally comprise a movable outer member such as a handle which may be moved with respect to the other portions of the tool to compress a spring bearing against an inner movable hammer retained by appropriate pawls or other types of latching arrangements. When the spring has been compressed to the desired extent, the pawls or latching devices are automatically disengaged and the hammer moves under the influence of the compressed spring to deliver an impact to the head of the tool.

It is a primary object of this invention to provide an impact tool in which the hammer spring is compressed and retained in a cocked position prior to application of the impact tool to the work piece.

It is another object of this invention to provide an impact tool which, in certain applications thereof, may be utilized to test the results of an impacting operation as the tool is being cocked in preparation for a subsequent operation.

It is a further object of this invention to provide an impact tool which will automatically cock the hammer and hammer spring upon the completion of an impact operation.

It is yet an other object of this invention to provide an impact tool having selectively operable means for automatically recocking the hammer and hammer spring if desired.

With these and other objects in view, the present invention contemplates an impact tool comprising a body portion and a handle telescopically disposed thereon. An anvil is slidably mounted within an aperture in the body portion at the end thereof opposite the handle. A hammer is slidably disposed within the body portion and a hammer spring is interposed between the hammer and an abutment formed on the interior of the body portion. Lost motion means are provided for connecting the handle to the hammer member whereby movement of the handle along the body and away from the anvil will compress the hammer spring. A latch is provided for engaging and holding the hammer in a cocked position when the hammer spring has been compressed to the desired extent. A camming arrangement is provided for releasing the latch upon movement of the handle toward the anvil to enable the hammer to deliver an impact to the anvil. A recocking spring is interposed between the handle and the body and selectively operable means are provided for compressing this spring, when desired, as the handle is moved toward the anvil to release the latch. When hand pressure is removed from the handle, this recocking spring will move the handle and hence the hammer away from the body and anvil to compress the hammer spring and recock the device. The spring constant of the recocking spring is sufficiently large to enable it to provide sufficient force to effect the recocking.

Other objects, advantages and novel features of the invention will become readily apparent upon consideration of the following detailed description when read in conjunction with the accompanying drawings wherein:

FIGURE 1 is a longitudinal section through a preferred embodiment of the present invention with the hammer and latch in the cocked position and with the recocking spring compressing members in their inoperative positions;

FIGURE 2 is a view similar to FIGURE 1 in which the handle has been moved forward to disengage the hammer latch and the hammer has delivered an impact to the anvil;

FIGURE 3 is a view similar to FIGURE 2 in which the recocking spring compressing members have been moved to their operative position and the recocking spring has been compressed as the result of the movement of the handle to effect an impacting operation;

FIGURE 4 is a perspective view of several internal parts which comprise the body portion of the tool;

FIGURE 5 is a sectional view taken along the line 5—5 of FIGURE 1 and illustrates the recocking cam with the recocking spring compressing members in their inoperative positions;

FIGURE 6 is a view similar to FIGURE 5 and illustrates the positions of the recocking cam when the recocking spring compressing members are disposed in their operative positions;

FIGURE 7 is a detail of the body portion and illustrates the grooves which accommodate a key carried by the handle;

FIGURE 8 is an elevation view of the impact tool of the present invention provided with a center punch type of impact head; and

FIGURE 9 is a fragmentary view similar to FIGURE 8 and illustrates a typical electrical terminal inserting head which may be used with the impact tool of the present invention.

Attention now is directed to the drawings, wherein like numerals of reference designate like parts through the several views, and more particularly to FIGURES 1 to 3. The impact tool of the present invention comprises a body portion and a handle designated generally by the reference numerals 10 and 11, respectively. The body portion is formed of a guide 12, a cam 14, and a barrel member 15. The guide 12 is threaded into the inner end of the barrel member 15 with the cam 14 disposed between the end of the barrel member 15 and a flange 16 formed on the guide 12. This relationship of these parts is best illustrated in FIGURE 4. The handle 11 comprises a sleeve 18, a bushing 19, and a cap 20. A portion of the sleeve 18 is spun into a groove formed in the bushing 19 as indicated at 21 to connect these two parts together and the cap 20 is threaded into the bushing 19 as shown to provide a smooth exterior for the handle.

An anvil 22 is slidably disposed within the barrel member 15 and is provided with a shank 24 which projects through the free end of the body member. The shank 24 is threaded on the free end thereof (FIGURES 8 and 9) to accommodate various types of impact heads. A spacer sleeve 25 (FIGURES 1–3) is disposed within the barrel member 15 and abuts the inner end of the guide 12. An anvil spring 26 is provided for normally urging the anvil 22 into contact with the spacer sleeve 25. A hammer 28 is slidably disposed within a central aperture 29 formed in the guide 12. A hammer projecting spring 30 is interposed between the inner end of the guide 12 and a head 31 formed on the hammer 28. A latching member 32 is disposed within a slot 33 formed in the interior of the guide 12, and has its forward end pivotally received in the forward end of said slot. The latching member 32 is provided with a projection 34 which engages an annular groove 35 formed in the hammer 28 to normally

preclude movement of the hammer under the influence of the hammer spring **30**.

A recocking spring retainer **36** is disposed within the handle **11** and is provided with flanges **38** and **39** at the ends thereof. A recocking spring **40** surrounds the retainer **36** and is disposed between the flanges **38** and **39** under substantial initial compression. A handle return spring **41** is interposed between the guide **12** and the flange **38** and normally serves to hold the spring retainer **36** against the bushing **19** as well as urging the handle **11** to its retracted position.

The guide **12** is further provided with three circumferentially spaced longitudinal slots **42** (FIGURE 4). A recocking spring compressing member **44** (FIGURES 1 to 3) is disposed within each of the slots **42**. A garter spring **45** is disposed within an annular groove **46** formed in the guide **12**. The groove **46** communicates with the slots **33** and **42** so that the garter spring **45** engages the latching member **32** and each of the spring compressing members **44**. The garter spring will normally urge all of these members to the positions shown in FIGURE 1.

A key **48** is secured to the inner wall of the sleeve **18** and is slidably disposed within a slot **49** formed in the cam **14**. A portion of the key **48** projects beyond the slot **49** and into a larger slot **50** formed in the body member **15**. This construction permits a limited amount of relative rotation between the sleeve **18** and the barrel member **15** while precluding relative rotation between the sleeve **18** and the cam **14**. The slot **50** has a projection **69** (FIGURE 7) formed therein which precludes longitudinal movement of the sleeve **18** relative to the barrel member **15** except when the sleeve **18** is rotated to either of its extreme positions with the key **48** in engagement with one side of the slot **50**. The exterior of the sleeve **18** and barrel member **15** are provided with indicia, designated generally by the reference numeral **52**, which serves to indicate to the user in which position the key **48** is disposed.

Operation

In order that a better understanding of the invention might be had, its mode of operation will now be described. Since the impact tool of the present invention may be cocked and operated in two different manners, these will be described separately. The first of these is the single operation in which the tool is recocked manually. The body portion **10** and handle **11** are first relatively rotated to position the indicia **52** as illustrated in FIGURE 8 with the arrow pointing to the word "Single." Any of various impact heads may then be attached to the tool by threading onto the shank **24**. For purposes of illustration, the "Single" operation of the impact tool will be described in connection with a taper pin inserter **54** (FIGURE 9) since the manual cocking arrangement has particular utility in connection with the insertion of taper pin connectors. The inserter **54** is provided with a recess **55** which accommodates a taper pin connector **56**. The handle **11** and body portion **10** are then grasped by hand and pulled in opposite directions. A retracting head **58** formed on the hammer **28** is engaged by the bushing **19** so that the hammer moves with the handle **11** to compress the hammer spring **30**. This arrangement provides a lost motion connection between the hammer and handle. When the handle **11** and body portion **10** have been pulled to the positions shown in FIGURE 1, the garter spring **45** depresses the latching member **32** to engage the projection **34** in the annular groove **35** and retain the hammer **28** in the cocked position.

When the handle **11** and body portion **10** were rotated to the positions shown in FIGURE 8, the key **48** caused the cam **14** to rotate with the handle **11** while the compressing members **44** were precluded from rotating therewith by the sides of the slots **42** which remain fixed in position relative to the body portion **10**. The cam **14** and compressing members **44** thus assume the positions

shown in FIGURE 5 with recesses **59** radially opposite end portions **60** of compressing members **44**. The garter spring **45** pivots the ends **60** of the members **44** into the recesses **59**. This position is best illustrated in FIGURE 1.

The tool is then ready for an impacting operation and the tapered pin connector **56** is inserted in the recess **55** as shown in FIGURE 9. The tip of the connector **56** is then positioned in a tapered aperture **61** formed in a mating connector **62**. The handle **11** is then gripped by the operator and pushed along the body portion **10** (to the right in FIGURE 1). As the handle **11** moves to the right, a conical cam surface **64** formed on the bushing **19** engages the latching member **32** and moves it to the position shown in FIGURE 2. This movement of the latching member **32** withdraws the projection **34** from the groove **35** and permits the hammer spring **30** to move the hammer **28** to bring the head **31** into contact with the anvil **22**. The impact of the head **31** on the anvil **22** is transmitted to the connector **56** by virtue of engagement of shoulders **65** with an annular flange **66** formed on the connector **56**. The impact drives the connector **56** into the tapered aperture **61** and into firm frictional engagement therewith. FIGURE 2 illustrates the relationship of the various parts immediately after the head **31** has struck the anvil **22**.

The handle **11** is then retracted by the operator with the inserter **54** still in engagement with the connector **56**. After a limited amount of movement, the shoulders **65** will engage surfaces **68** on the connector **56** and restrain further axial movement of the inserter **54**. The operator continues to retract the handle **11** until the latching member **32** drops into the latching position shown in FIGURE 1. This will be evidenced by an audible click. By using the inserted connector **56** to restrain one end of the tool during this recocking operation, the connection between the connectors **56** and **62** is tested by the application of the force necessary to compress the hammer spring **30** to the cocked position shown in FIGURE 1. The spring constant of hammer spring **30** is selected so that the recocking force is equal to the desired test force. If the connection is a faulty one incapable of withstanding the test force, then the connectors will separate before the tool can be recocked. If it is not desired to test the connection thus made, or if an impact head other than the taper pin inserter **54** is used, then the tool may be manually recocked in the manner previously described.

In many applications of impact tools, it is desirable to eliminate the manual recocking operation. This may be accomplished in the following manner with the impact tool of the present invention. The handle **11** and body portion **10** are rotated so that the arrow of the indicia **52** is in the "Repeat" position. The key **48** is then disposed against the opposite side of the slot **50**. It should be noted that the slot **50** is provided with elongated portions **69** which serve to accommodate the key **48** as the handle **11** is moved forward along the body portion **10**. Rotation of the handle **11** has caused rotation of the cam **14** to the position shown in FIGURE 6. Again, the compressing members **44** have been prevented from rotating with the handle **11** by the sides of the slots **42**. The cam surfaces defined by the slots **59** on the cam **14** engage the ends **60** of the members **44** and push them to the bottom of the slots **42** against the urging of the garter spring **45** as the cam **14** is rotated to the position shown in FIGURE 6. The members **44** are then disposed parallel to the longitudinal axis of the tool and in alignment with the recocking spring **40**. This position of the members **44** is best illustrated in FIGURE 3. The impact tool may then be equipped with any of various impact heads such as the center punch head **70** shown in FIGURE 8. The tool may then be initially cocked manually as previously described.

The tool is then placed with the tip of the center punch **70** touching the work piece (not shown) as the point

where a center punch mark is desired. Again the handle **11** is moved along the body portion **10** to trip the latching member **32** and deliver an impact to the center punch **70**. In this instance however the recocking spring **40** is further compressed by this movement of the handle **11** along the body portion **10** since the right-hand end of the spring **40** is engaged by the ends of the compressing members **44** as the handle moves to the right. The retainer **36** is provided with slots **71** which accommodate the ends of the compressing members **44** and thus permit the retainer **36** to move with the handle **11** as the spring **40** is being compressed. It will be noted that the recocking spring **40** was not compressed during the "Single" operation because the ends of the compressing members **44** were pivoted away from the end of the spring **40** as shown in FIGURE 2. After the impact has been delivered to the center punch **70**, the operator releases the pressure exerted on the handle **11**. The compressed recocking spring **40**, acting on the handle **11** through the flange **38** and on the body portion **10** through the compressing members **44**, forces the handle back along the body portion. Again the bushing **19** engages the head **58** to compress the hammer spring **30** and automatically recock the tool. As was previously mentioned, the spring **40** is initially compressed between the flanges **38** and **39**. The spring constant of the spring **40** and the initial compression thereof are calculated to exert a sufficient force to overcome the hammer spring **30** and recock the tool. When the tool has been automatically recocked in this manner, the spring **40** is still in engagement with the ends of the compressed members **44** and is just slightly lifted away from the flange **39**. This arrangement is necessary in order that the tool may be completely cocked. The compressing members **44** are provided with level surfaces **72** which enable the members **44** to cam the righthand end of the spring **40** slightly away from the flange **39** when the members **44** are initially pivoted to the position shown in FIGURE 3.

It will be obvious from the foregoing description that a new and improved impact tool is provided by the present invention. The tool is susceptible of either manual or automatic recocking dependent upon the operation involved and the desires of the operator. Although the invention has been disclosed in connection with center punch and taper pin inserter impact heads, it will be obvious to those skilled in the art that the tool of the present invention may be used with equal facility with all types of impact heads. Although the single operation has been described in connection with a taper pin inserter and the repeat operation has been described in connection with a center punch, it is obvious that these could be reversed. The tool will function equally well to insert taper pins in the repeat position although the testing by recocking operation cannot be performed and center punching can be accomplished with the tool in the single position although manual recocking will then be necessary. The nature of the operations to be performed will be the deciding factor in determining which position is to be used. The repeat position has particularly utility in operations such as punching and driving various types of fasteners when used in conjunction with an appropriate magazine feed for the fasteners.

It is to be understood that the above described arrangements are simply illustrative of a preferred embodiment of the invention incorporating the principal features thereof. Numerous other arrangements and embodiments may be readily devised by those skilled in the art to achieve a similar device which still embodies the principles of the present invention and falls within the spirit and scope thereof.

What is claimed is:

1. An impact tool comprising:
   (*a*) a tubular handle
   (*b*) a hollow body portion telescopically movable within said handle,
   (*c*) an anvil slidably disposed within said body portion, and carrying a tool head projecting from said body portion,
   (*d*) a hammer slidably disposed within said body portion
   (*e*) resiliently compressible means interposed between said hammer and an abutment fixed on said body portion so as to normally urge said hammer toward said anvil,
   (*f*) tractive means connecting said hammer to said handle whereby retractive movement of said handle along said body and away from said anvil will pull said hammer rearwardly and compress said resilient means between said hammer and said body portion abutment,
   (*g*) latch means for engaging and holding said hammer in a cocked position when said resilient means has been compressed to the desired extent, and
   (*h*) means on said handle for disengaging said latch means when said handle is moved along said body portion toward said anvil whereby said hammer delivers an impact to said anvil under the influence of said resilient means.

2. An impact tool as defined in claim 1 wherein said tractive means comprises a lost motion device including an enlarged head formed on the rearward portion of said hammer and disposed within a counterbored recess in the end of said handle whereby movement of said handle in one direction causes corresponding movement of said hammer while said handle may be moved in the opposite direction independently of said hammer.

3. An impact tool as defined in claim 1 wherein said latch means comprises an elongate member pivoted on said body portion for movement in a radial plane and having a projection thereon adapted to engage an annular groove formed in said hammer.

4. An impact tool as defined in claim 3 wherein said disengaging means comprises a cam carried by said handle and adapted to engage the free end of said elongate member as said handle is moved toward said anvil and pivot said elongate member to move said projection out of said groove whereby said hammer is free to move under the influence of said resilient means.

5. An impact tool comprising:
   (*a*) a tubular handle having an open end and a closed end,
   (*b*) a hollow cylindrical body portion telescopically disposed within the open end of said handle,
   (*c*) an anvil slidably disposed within said body portion having a shank thereof projecting beyond said body portion and away from said handle,
   (*d*) a guide disposed within said handle and secured to the inner end of said body portion,
   (*e*) a hammer slidably disposed within said guide and having an enlarged head formed thereon and disposed within said body portion,
   (*f*) a helical spring interposed between the enlarged head on said hammer and the inner end of said guide and normally urging said head toward said anvil,
   (*g*) an enlarged portion formed on the opposite end of said hammer and disposed within a counterbored recess in the closed end of said handle to provide a lost motion connection between said hammer and said handle whereby movement of said handle away from said anvil causes corresponding movement of said hammer to compress said helical spring while said handle may be moved in the opposite direction independently of said hammer,
   (*h*) an elongated latching member pivoted in a longitudinal slot in said guide for movement in a radial plane and having a projection thereon adapted to engage an annular groove formed in said hammer for holding said hammer in a cocked position when said helical spring has been compressed to the desired extent,

(*i*) resilient means on said guide normally urging said latching member toward said hammer, and

(*j*) and a cam carried by said handle and adapted to engage the free end of said latching member as said handle is moved toward said anvil and pivot said latching member to move said projection out of said groove whereby said hammer is free to deliver an impact to said anvil under the influence of said helical spring.

6. An impact tool as defined in claim 5 provided with:

(*k*) a cylindrical spring retainer carried by said handle and having a flange formed on each end thereof,

(*l*) a recocking spring disposed between the flanges on said spring retainer under initial compression,

(*m*) a plurality of compressing members disposed in longitudinal slots in said guide for pivotal movement in radial planes and normally pivoted toward the longitudinal axis of said tool by said resilient means,

(*n*) the rearward ends of said compressing members being accommodated in axial slots formed in said spring retainer and being disposed inside the cylindrical plane defined by said recocking spring when in their innermost positions, and

(*o*) cam means carried by said handle and operable upon relative rotation between said handle and said body portion for pivoting said compressing members into the cylindrical plane of said recocking spring whereby said recocking spring will engage the ends of said compressing members and be further compressed upon movement of said handle toward said anvil.

7. An impact tool comprising:

(*a*) a hollow tubular body portion,

(*b*) an anvil slidably disposed within said body portion and carrying a tool head projecting from said body portion,

(*c*) a hammer slidably disposed within said body portion,

(*d*) a projecting spring within said body portion compressed between said body portion and said hammer for projecting said hammer toward said anvil when released from compression,

(*e*) a handle member operatively connected with said hammer to retract it against the urging of said spring,

(*f*) latch means for engaging and holding said hammer in a cocked position upon retraction thereof against said spring to a predetermined point,

(*g*) trip means also actuated by said handle for releasing said latch means to permit said projecting spring to project the hammer toward said anvil,

(*h*) a second spring of greater resistance than said projecting spring disposed between said handle member and said body portion and uring said handle member strongly away from said hammer and anvil, whereby upon release of the handle after the latch has been tripped the handle is projected rearwardly away from latch releasing position whereby the latch is again engaged and the hammer cocked.

8. The impact tool as defined in claim 7 in which there are provided movable abutment means carried by one of the recited parts between which the said second spring is disposed, and manually operable means for adjusting said abutment means into and out of positions of operative contact with the adjacent end of said spring.

9. The impact tool as defined in claim 8 in which said adjustable means includes at least one member pivoted on said body portion for movement in a radial plane between first and second positions, said pivoted element being operative to engage said strong re-cocking spring to effect compression thereof as said handle is moved toward said anvil only when said pivoted member is disposed in said second position, and a cam device operatively connected with said handle and adjustable upon rotative movement of said handle to swing said pivoted member to and from said first and second positions.

10. The impact tool as defined in claim 9 in which there is provided a narrowed substantially cylindrical extension on the rearward end of said body portion alongside of which said pivoted adjustable re-cocking spring engaging member is disposed, said latch comprising an elongated element pivoted upon a part of said body portion and also disposed alongside of said cylindrical extension; in which the second or engaging position of said adjustable pivotal member is a radially outward one and the engaging position of said latch is a radially inward one; and in which a garter spring surrounds both the adjustable pivoted member and the latch element to yieldably urge the latch element toward engaging position and the adjustable pivoted member toward disengaged position against the respective actions of the cam device and the latch trip means.

11. The impact tool as defined in claim 10 in which the cylindrical extension of the body portion is provided with radial slots accommodating the movement of said adjustable pivoted members and said latch element, and a circumferential groove intersecting said slots and accommodating said garter spring.

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