Oct. 9, 1951 C. N. BUCK 2,570,914

NAIL PULLER

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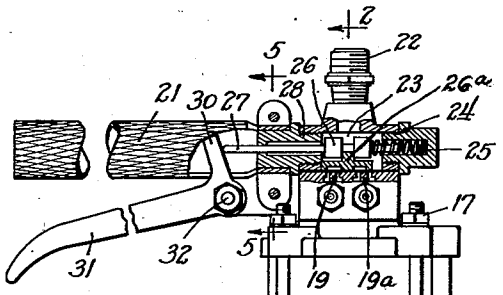


Fig. 1.

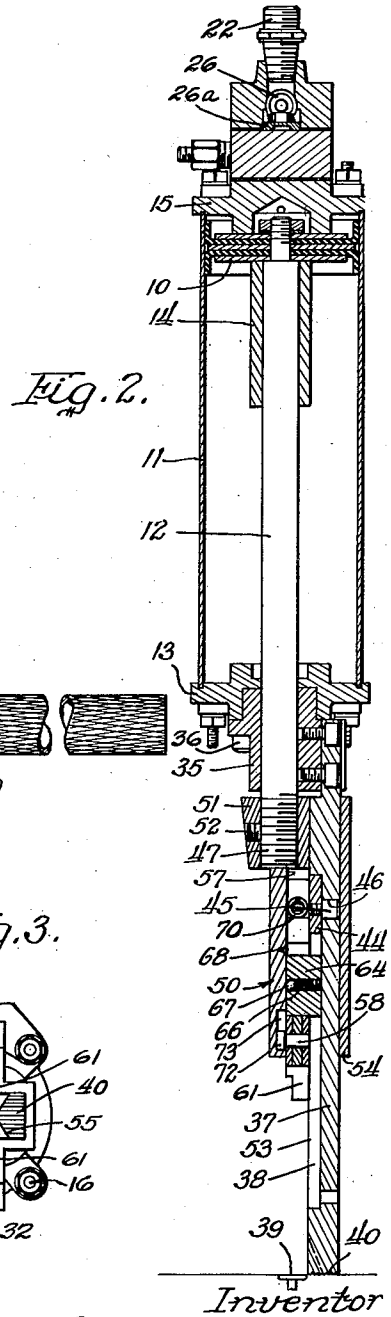


Fig. 2.

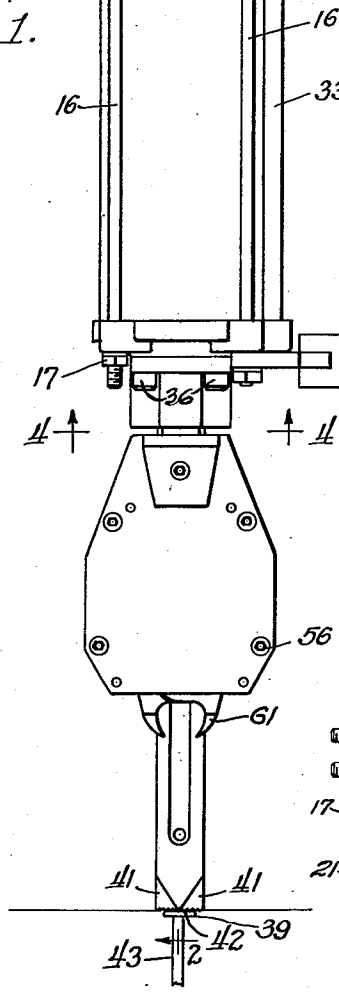
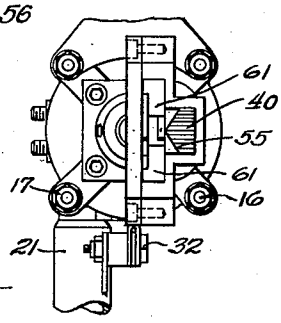


Fig. 3.



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Fig. 6.

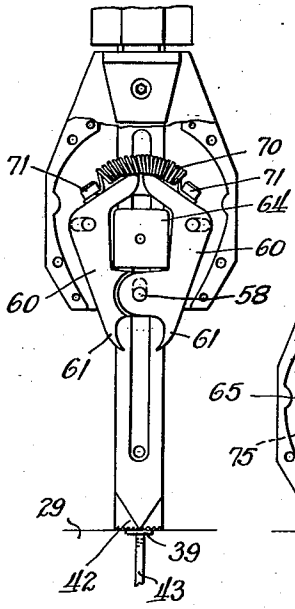


Fig. 7.

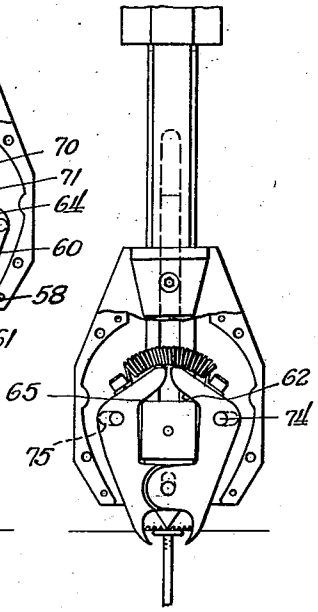


Fig. 8.

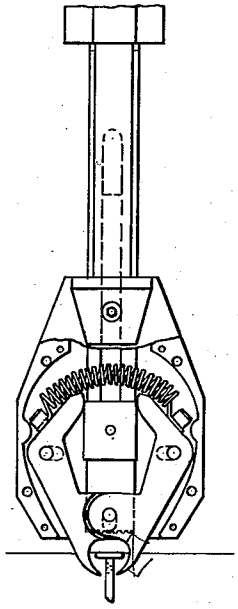


Fig. 9.

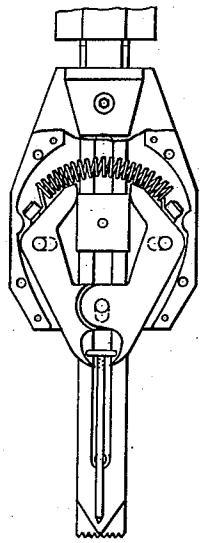


Fig. 4.

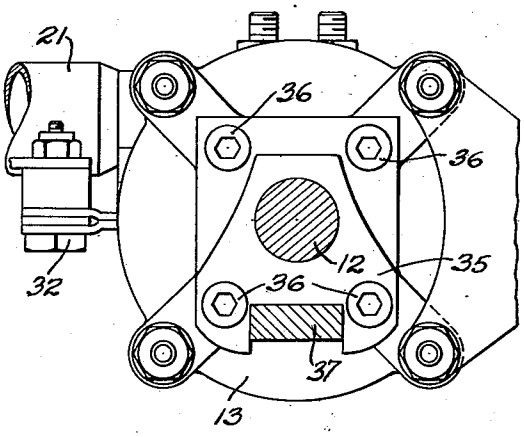
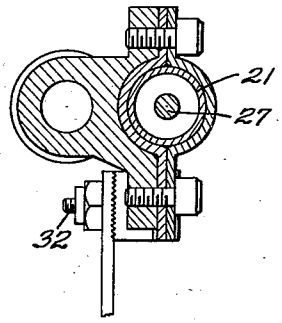


Fig. 5.



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NAIL PULLER

Clarence N. Buck, Chicago, Ill.

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11 Claims. (Cl. 254—18)

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The present invention relates to nail pullers and certain improved constructions and arrangements of elements by which a nail is quickly withdrawn rectilinearly from its lodgment.

Nail pullers heretofore used have been of the hammer-lever construction in which a vertical shaft is pivoted to a horizontal shoe, and both the shoe and shaft are provided with jaw members to grip the nail when the shaft is tilted in the direction of the shoe. A heavy slip sleeve upon the shaft is used as a slide hammer to drive the jaws into the wood on opposite sides of the nail before the jaws are levered to grip the nail. Thereafter the shaft is levered about the shoe to pull the nail through an arc which bends the nail and renders it unfit for further use.

Such nail pullers require long shafts so that the back stroke of the hammer will not displace the jaws from their proper position. On the other hand, a heavy hammer and a short stroke is extremely tiring to an operator when a nail puller is to be used for any length of time. Not only this, but the conventional nail pullers require a great deal of space around the nail to allow for leverage movement of the shaft and the direction of this leverage is limited because the shoe has to rest upon a substantial length of the board in which the nail is driven, for obvious reasons. Furthermore, the slightest deviation from the plane of leverage movement causes the shoe to slip and break away from the nail with corresponding danger of injury to the operator exerting leverage pressure upon the nail puller.

The invention eliminates these difficulties and further removes the nails without injury to them so that they can be reused again and again.

The invention is further characterized by preserving the vertical spacing of the operator's hands for easy management of operations without the hands being endangered by relative moving parts as is the case with conventional nail pullers.

Another object of the invention is to provide a nail puller which retains its grip upon the nail throughout repeated applications of force if such are necessary to pull a nail from a hard piece of wood.

The invention is further characterized by automatically releasing the nail when it is completely clear of the wood and resetting itself for pulling the next nail.

A further object of the invention is to grip the nail only when the jaws are deep enough in the wood to close upon the shaft of the nail below the head and then to close the jaws with a combination of cooperating forces which not only guides the jaws to a closed position but locks the jaws closed with a reaction force which preferably provides a lost motion between the nail puller body and the board holding the nail so that initial reverse movement of the parts gains the advantage of an inertial head start to jerk and unseat the nail from its set position to start its withdrawal. With the head start thus provided, the full weight of the nail puller body is brought into play in preference to the use of only part thereof or the use of additional weight.

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Furthermore, the invention exerts a tugging action without hammering and eliminates objectional noise generally accompanying conventional nail pulling.

Other and further objects of the invention, including simplicity of construction and operation, will become apparent from the drawings, the description relating thereto, and the appended claims.

Referring now to the drawings,

Fig. 1 is a front view, partly in section, of a construction embodying a preferred form of the invention in position ready to pull a nail;

Fig. 2 is a sectional view of the construction shown in Fig. 1, as taken upon line 2—2;

Fig. 3 is a bottom view of the lower end of the construction shown in Fig. 1;

Fig. 4 is a section taken upon line 4—4 in Fig. 1;

Fig. 5 is a section taken upon line 5—5 in Fig. 1;

Fig. 6 is a diagrammatical view taken from the front of the construction shown in Fig. 1 with the jaws open and the nail pulling head in raised position;

Fig. 7 is similar to Fig. 6 showing the jaws as they contact the wood around a nail head;

Fig. 8 shows another position of the nail pulling head in which the jaws have penetrated the wood and closed upon the nail; and

Fig. 9 shows another position of the head with the nail withdrawn and about to be ejected.

The invention contemplates driving two pivoted jaws into a board on opposite sides of a nail head and, as the jaws move in, contracting and locking the jaws in contracted position below the nail head; lifting the jaws a full distance to remove and clear the nail from the board, and thereafter expanding the jaws to discharge the nail without mutilation. It is preferred that the jaws be so mounted on a guideway member that they overrun the guideway when driven into the board, thus lifting the guideway member clear of

the board during the time that the jaws are being contracted around the nail. This readies the nail puller to exert the extra heavy force needed to start the nail by providing a moment during which the relative movable parts of the puller acquire a relative momentum before effort is exerted upon the nail. Under this relative momentum the guideway member again engages the board with a blow and reaction effort sufficient to dislodge the nail from its set position prior to fully withdrawing the nail.

The apparatus employed embodying the invention includes a fluid actuated piston 10 disposed in a cylinder 11 and a piston rod 12 connected thereto which slides in and out through a front head 13 on the cylinder. A spacer 14 upon the piston rod determines the outward limit of movement. A second or rear head 15 is provided at the upper end of the cylinder and the two heads are tied together by stud bolts 16 and nuts 17 disposed at opposite ends thereof. Two of the nuts upon one side and at the front end of the cylinder secure a laterally projecting handle 20 in place, while two nuts upon the opposite side and at the back end of the cylinder secure a second handle 21 in place so that the device can be manipulated by holding the handle 20 in the left hand and the handle 21 in the right hand.

The piston is moved by fluid pressure such as air under a commonly used pressure of ninety pounds per square inch. The air is received through the nipple 22 threaded in the rear head 15 and directed into the chamber 23 of a valve 24 which has a slide element 26 and plate urged to one limit of its movement by a spirng 25. The slide element at the end opposite the spring 25 has a push rod 27 extending axially therefrom. The rod passes through gland packing 28 and into engagement with the short arm 30 of a lever 31 pivoted to the rear handle 21 as at 32. A depressing of the lever 31 drives the element 26 against the spring and moves it to its secondary position. Releasing the handle permits the spring to return the element 26 to its starting position.

A slide valve member 26*a* is engaged and driven by the element 26. This member is disposed so as to slide over pairs of ports 19 and 19*a*. In the starting position shown, the pair of ports 19 is in communication, connecting the upper end of the cylinder to the atmosphere. One of the ports 19*a* of the second pair is open to the space 23 to admit air to the lower end of the cylinder, and the vent port of the pair is closed. When the handle 31 is pressed, the slide valve member 26*a* is moved to the other side, connecting the pair of ports 19*a* to vent the lower part of the cylinder and connecting one of the ports 19 to the space 23 to supply air to the upper part of the cylinder.

In its starting or resting position the air under pressure is directed to flow into the cylinder on the rod side of the piston through the valve port 19 and a conduit 33 running down the outside of the cylinder. This returns and holds the piston at its rearward position. The rear portion of the cylinder is vented to atmosphere to permit this. In the secondary position of the valve, as when the lever is depressed, the front end of the cylinder is vented to atmosphere and the air under pressure is directed into the cylinder behind the piston to force it frontwardly.

Thus, depressing the lever drives the piston rod downwardly with a quick, power-driven action, and releasing the lever will cause a quick, power-driven lifting or retraction of the piston rod. This control of the piston can be accomplished by the right hand while the cylinder is held in supported working position.

A sleeve 35 guiding the piston rod 12 is held in place upon the forward head 13 by machine screws 36 and has attached to it as shown in Fig. 2 a bar 37 which has a longitudinal groove 38 on the piston rod side of the bar. The end face of the bar is knurled as at 40 and the two adjacent corners on the piston side of the bar are faced off as at 41 to leave a pointer contour 42. The pointer is used to locate the bar with respect to a nail 43 and the knurled end face 40 prevents slipping. At the upper end of the groove 38 an interchangeable stop member 44 is held against longitudinal displacement by the head of a machine screw 45 resting snugly in a hole 46 in the bar.

The exposed end of the piston rod 12 is threaded as at 47 to engage in a threaded boss 51 upon a housing member 50 where it is held against loosening by a setscrew 52. The housing member slides up and down on the bar, against the front face 53 thereof, and is guided by a cover member 54 channeled as at 55 to receive the bar as held in place by machine screws 56 whose heads are preferably countersunk in the housing where the stock is thick enough to receive them without weakness.

The housing member and cover member define a cavity 57 within which the nail gripping and release elements are supported. Referring to Fig. 6, two jaw elements are pivoted to each other as at the pivot pin 58 located intermediate their ends so that the expansion of the arms 60 causes the jaws 61 to close towards each other.

The jaws are curved inwardly like the ends of a crescent and preferably are made out of tool steel to withstand striking against hard wood, metal binding tape or sheet steel. The arms are shaped to define a space between them and tapered upwardly at 62 to provide camming surfaces between them. A block or cam 64 is slidably mounted in the groove 38 upon the bar 37 where it lies between the arms 60 inside the camming surfaces 62, the upper corners 65 engaging the camming surfaces being rounded for easy sliding along the camming surfaces. As shown in Fig. 2, the block has a well 66 in it receiving a spring pressed ball 67 engageable in a detent 68.

A tension spring 70, with upset loops at each end secured against the outer faces of the arms 60 by screws 71, urges the jaws 61 to their open position by drawing the arms towards each other.

At the upper or rearward limit of the housing movement, the floating block engages the stop 44 and is held or driven thereby from between the ends of the arms 60. At the lower or forward limit of the housing movement, the floating block engages the lower end of the groove and is held there as the housing approaches its limit of movement as determined by the length of the sleeve 14. During the last increment of downward movement under the force of the piston, the block is stationary but moves along the camming surfaces 62 as the housing carries the arms downwardly and moves between the arms to accomplish their separation and the corresponding closure of the jaws. In this position the ball engages in the detent to keep the block from jarring out of position on the back stroke until such time as the stop 44 engages the block and

carries it from between the ends of the arms as already mentioned.

The driving force between the housing and the jaws is carried mainly at two points so that the load is not only distributed between several elements, but the jaws are steadied against veering. This is accomplished by two pins 74, one upon each arm, slidable laterally in transverse grooves 75 in the housing as the arms are expanded. Lateral expansion is allowed for by mounting the head 72 of the pivot pin to slide in a vertical groove 73 in the housing. The two pins 74 carry most of the load of protraction and retraction insofar as the work effort upon the jaws is concerned. However, these pins share the load and in conjunction with the pivot pin support the jaws against veering when driven downwardly to grasp the nail below the head.

In operation, the resting position of the head is shown in Fig. 6 where it is held in its retracted position by air pressure admitted to the cylinder on the rod side of the piston as when the valve 26 is in its resting position under the influence of the compression spring 25. The pointer 42 is located opposite the head 39 of the nail 43 where it is embedded in a wooden board 29. This is best accomplished by holding the handle 20 in the left hand and the handle 21 in the right hand.

The lever 31 is then depressed. This moves the valve to its alternate position, air below the piston is vented to the atmosphere, and air under pressure enters the cylinder above the piston. This drives the piston downwardly, carrying with it the head and the floating block 64.

The next station of interest is reached when the block 64 reaches the end of the groove 38 in its downward movement as shown in Fig. 7. At this time the jaws have begun to pierce the wood and the rounded upper corners 65 of the block 64 engage the cam surfaces 62 of the arms 60. In this position the lower end 40 of the bar 37 is still in contact with the wood and the head is still moving downwardly.

The downward drive of the head has ended in Fig. 8. The jaws have been driven deeper into the wood. The arms 60 have been driven along the rounded corners and have been expanded by the block to close the jaws around the nail head. The spring pressed ball 67 has engaged in the detent 68, and the overthrow provided between the bar 37 and the head 50 as determined by the length of the sleeve 14 has operated to raise the lower end 40 of the bar away from the board as a preferred preliminary to the back or reverse stroke of the piston.

The lever 31 is then released. The valve resumes its normal position. The upper portion of the cylinder is vented to the atmosphere and air under pressure is fed into the cylinder below the piston. When this occurs the head and bar begin to move with respect to each other with quick acceleration. The bar being raised above the board a short distance enables the building up of this relative inertial movement between the bar and head before a withdrawing force is exerted against the nail. This movement in substance builds up sufficient energy that when the bar again engages the board with a blow-like force, the reaction jars the nail loose from its embedded position and the piston thereafter merely tugs a moving nail. Invariably the nail is loosened and withdrawn with one application of force, but if it is not, manipulation of the lever will cause repeated blows and reaction of elements until the nail is dislodged enough that the direct pull of the piston is adequate to complete withdrawal of the nail.

The next station of interest is then shown in Fig. 9 where the nail has just cleared the board and is about to be ejected. The nail is straight and as good as new for reuse. As shown, the block has just come into contact with the stop 44 and can go no further. But the head having a predetermined distance yet to go disengages the detent 68 and moves the arms from off the sides of the block whereupon the block is freed and the arms are also freed to be contracted by the compression spring 70 with sufficient snap and force that the nail is discharged to fall free of the jaws. Therewith, the nail puller is reset for the next operation in which the pointer 42 is located at another nail for repeated operation.

It is preferred that the jaws be of uniform thickness up to a certain point where a shoulder is preferably provided. Thus they never wedge into the wood and come clean without drag from the fracture they impose upon the wood. The shoulder is useful in preventing the jaws from going too deep if a soft spot in the wood is encountered. This preserves the overthrow or lost motion lift of the bar from the wood so that inertial starting blow is assured each time.

Consequently, although a preferred embodiment is shown, it will be apparent to those skilled in the art from the description of preferred forms how various and further modifications can be made without departing from the spirit of the invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. In a nail puller, the combination of a guide member, a slide member, a loose element having cam surfaces thereon carried by one member for movement with respect to the other member, a pair of stops for limiting movement of the loose element with respect to the other member, nail gripping jaws pivotally mounted on the slide member including actuating arms cooperating with said cam surfaces, said element being disposed between said arms and movable when one stop is approached to close said jaws by displacement of said arms and to release the jaws when the other stop is reached by movement from between the arms, said slide member having a greater distance of travel than said element.

2. In a nail puller, a support member for engaging a workpiece, a pair of jaws reciprocably mounted with respect to said member for gripping a nail in the workpiece, and means for driving the jaws beyond the support member into the workpiece around the nail to lift the support from contact with the workpiece, said means also driving the support into contact with the workpiece in close proximity to the nail to deform a portion of the workpiece surrounding the nail preliminary to and as a part of applying withdrawing movement of the jaws upon the nail.

3. In a nail puller, a support member for engaging a workpiece in close proximity to the nail to be withdrawn, an element carrying a nail grasping member reciprocably mounted on said member, said jaws being adapted to penetrate said work piece, and means for driving the nail grasping member beyond the end of the support member a distance substantially greater than the penetration of the workpiece by the nail grasping member to lift the support from contact with the workpiece, said means also driving the support into contact with the workpiece to deform a

portion of the workpiece proximate to the nail and develop an inertial blow to move a portion of the workpiece with respect to the nail to overcome starting friction and apply withdrawing movement of the nail grasping member upon the nail.

4. In a nail puller, the combination including a guide member, a slide member, a loose element carried by the slide member, a pair of stops on said guide member for limiting motion of said loose element in both directions, a pair of jaws pivotally mounted on said slide member and including actuating arms, said element bearing against said arms when one stop is approached to close the jaws by displacement of the arms and moving away from said arms when the other stop is reached to permit the jaws to open, and resilient means for opening said jaws under such conditions.

5. In a nail puller, a support member for engaging a workpiece, means for reciprocably mounting a pair of jaws for gripping a nail in the workpiece, said means being so constructed and arranged as to permit said jaws to move to a position extending beyond the end of the support member into the workpiece around the nail to lift the support from contact with the workpiece a distance substantially in excess of the normal penetration of the jaws in the workpiece, means for driving the jaws to said position from a retracted starting position, said last mentioned means also driving the support into contact with the workpiece to develop an inertial movement preliminary to applying withdrawing movement of the jaws upon the nail.

6. In a nail puller, a support member for engaging a workpiece, a head including a pair of jaws reciprocably mounted on said member, said jaws being adapted to penetrate said work piece, the clearances between said member and said head being such as to permit said pair of jaws to be moved to a position beyond the end of the support member a distance substantially greater than the penetration of the workpiece by the jaws to lift the support a substantial distance from contact with the workpiece, and means for driving the jaws to such position, said last mentioned means also driving the support into contact with the workpiece to develop an inertial movement preliminary to applying withdrawing movement of the jaws upon the nail.

7. In a nail puller, a piston member and a cylinder member including means for reciprocating the piston under power in both directions, a support element for engaging a workpiece carried by one of the members, a pair of jaws for gripping a nail in the workpiece carried by the other member, said jaws being adapted to penetrate said work piece, the clearances of said members being such as to permit said jaws to extend to a position beyond the support member a distance substantially greater than the penetration of the workpiece by the jaws at one limit of relative movement between the jaws and the support, and means for opening and closing said jaws at opposite limits of said relative movement.

8. In a nail puller, the combination of a guide member, a slide member mounted for reciprocable movement with respect to said guide member, jaws carried by said slide member to grip a nail to be pulled, a loose cam element for actuating said jaws, said element being loosely carried by said slide member for longitudinal movement with respect to the other member, and stops on one of said members for limiting movement of said cam element, said element closing said jaws when one stop is reached and releasing said jaws when the other stop is reached and said slide member having a greater distance of travel than said element.

9. In a nail puller, the combination of a supporting guide member, a slide member, a pair of jaws carried by said slide member for gripping a nail to be pulled, means including an element movably mounted on said slide member for actuating said jaws, and stops for limiting movement of said movable element with respect to said guide member, said means for actuating said jaws closing said jaws when said movable element reaches one of said stops and opening said jaws when it reaches the other stop and said slide member having a greater distance of travel than the movable element.

10. A nail puller comprising a guide member, a slide member, a loose element having a cam surface thereon carried by the slide member for movement relative to the guide member, a jaw pivotally mounted on the slide member and having an actuating arm, a pair of stops for limiting movement of said element, said element being movably mounted adjacent said arm and movable when one stop is approached to close said jaw by displacement of said arm as the cam surface cooperates with said arm and to release said jaw when the other stop is reached by movement relative to said arm, said slide member having a greater distance of travel than said element, and means for reciprocating said slide member.

11. The method of withdrawing a nail embedded in a workpiece including moving a nail engaging element toward said workpiece at a relatively high velocity to cause said element to penetrate said piece beneath the head of said nail, moving the element into contact with said nail to engage same, and striking a blow against the workpiece in close proximity to said nail head while simultaneously exerting an upward force upon said element to withdraw said nail.

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