

Nov. 9, 1954

E. J. HABOUSH
 DEVICE FOR BENDING, CUTTING AND EXTRACTING
 THE BONE NAILS, NAILPLATES, AND THE LIKE

2,693,798

Filed April 23, 1951

2 Sheets-Sheet 1

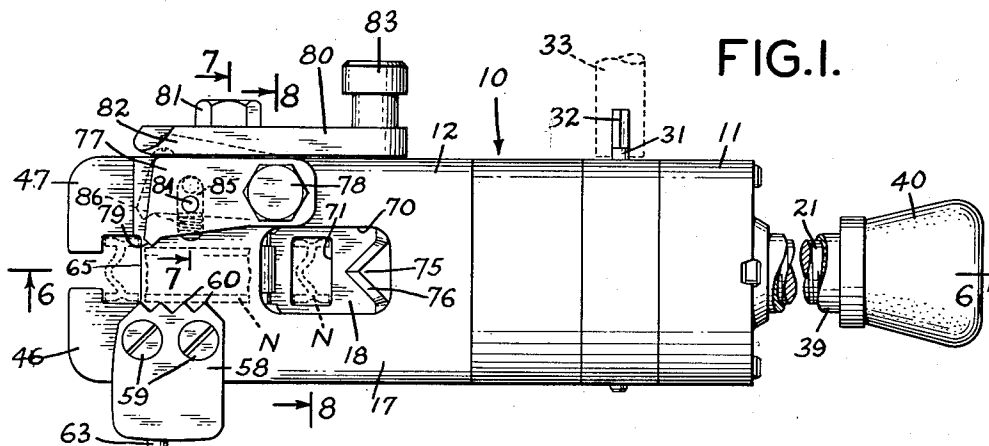


FIG. 1.

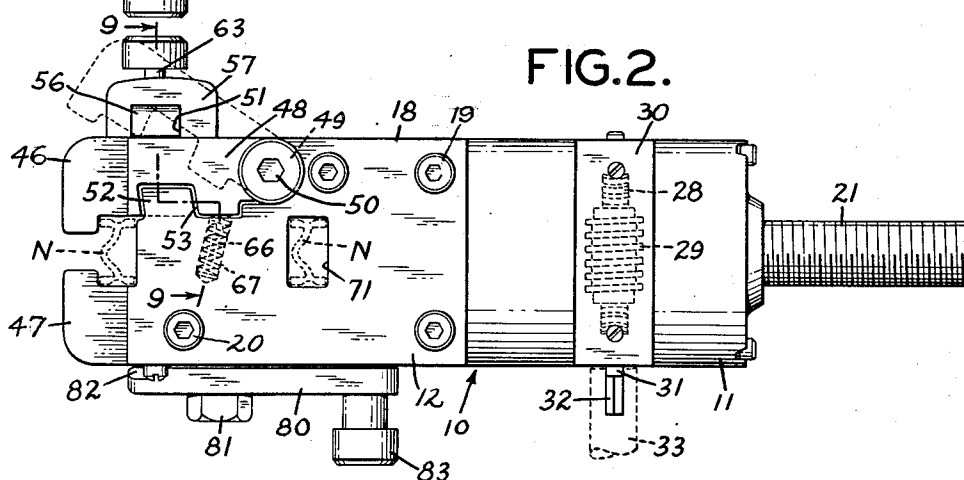


FIG. 2.

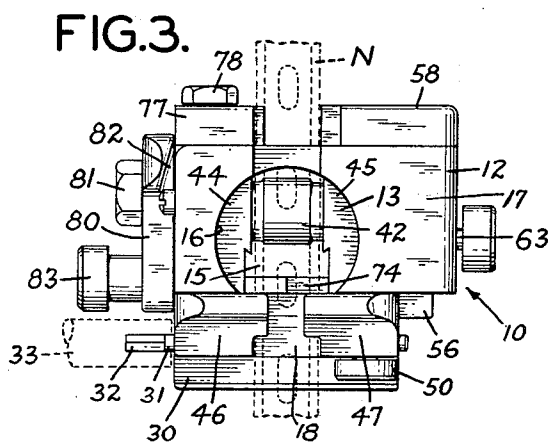


FIG. 3.

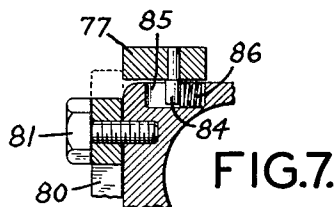


FIG. 7.

INVENTOR.
 EDWARD J. HABOUSH
 BY
Campbell, Brumbaugh, Fox & Davies
 HIS ATTORNEYS.

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FIG. 4.

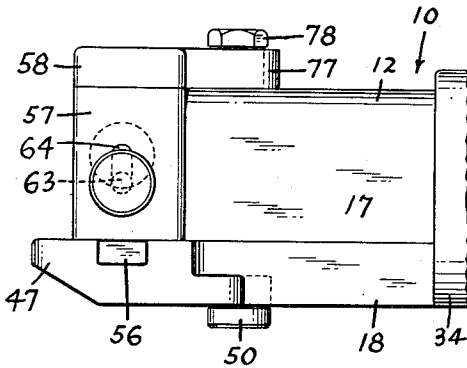


FIG. 5.

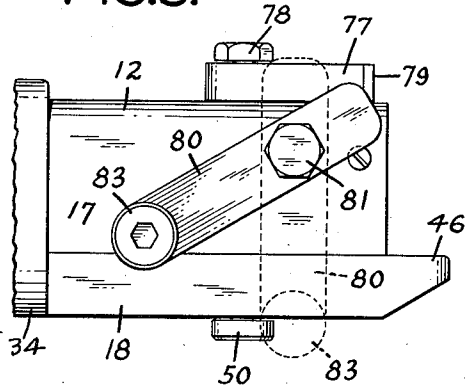


FIG. 6.

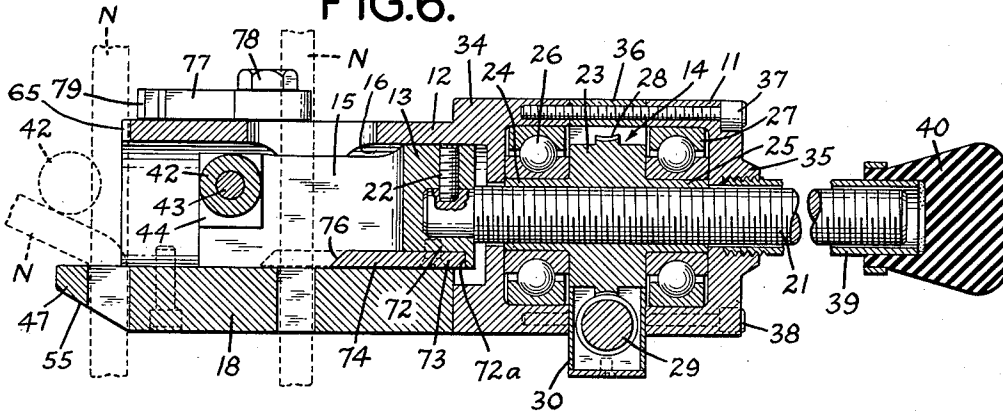


FIG. 8.

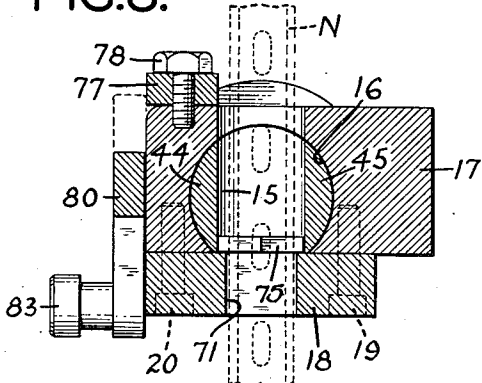
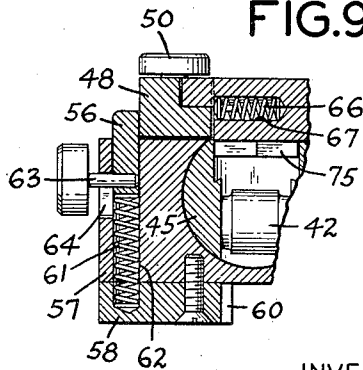


FIG. 9.



INVENTOR.
 EDWARD J. HABOUSH

BY
Campbell, Brumby, Frost & Jones
 HIS ATTORNEYS.

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2,693,798

DEVICE FOR BENDING, CUTTING AND EXTRACTING THE BONE NAILS, NAILPLATES, AND THE LIKE

Edward J. Haboush, Brooklyn, N. Y.

Application April 23, 1951, Serial No. 222,398

8 Claims. (Cl. 128—83)

This invention relates to surgical instruments and more particularly to improvements in devices for bending, cutting and extracting bone nails, nail plates and the like used for the fixation of fractures.

Heretofore, the devices for bending bone nails, nail plates and the like have consisted of metal brakes which are operated manually. Inasmuch as they are usually mounted on a bench or stand, they are not adapted to be used after the nail or nail plate has been driven into or affixed to the bone.

When it is necessary to cut a nail or a nail plate to a desired length, conventional manually operated metal shears have been used. Such shears are inconvenient to use when the nail has been driven partially into the bone and even when the nail is free because of the thickness and strength of such nails.

In my copending application Serial No. 130,253, filed November 30, 1949 now Patent No. 2,590,532, granted March 25, 1952 I have disclosed an improved form of nail bending device which greatly facilitates the bending and insertion of bone nails and the like. My prior nail bending device marks a considerable advance over the prior manually operated brakes but it is not a complete answer to all of the problems of bending, cutting, extracting and impacting encountered by the surgeon in the fixation of fractures with nails, nail plates and the like.

The present invention is an improvement over the device shown in my Patent No. 2,590,532 in that it embodies, in one compact and easily handled instrument, all of the mechanism necessary for cutting, extracting and bending bone nails and nail plates and makes possible all of these operations either while the nail or nail plate is free or after it has been partially inserted in or fixed to the bone.

More particularly, the new device includes a casing having nail holding or gripping elements thereon which position a nail or nail plate so that an abutment member or a shear member on a power driven carriage movable in the casing can bend or cut the nail or nail plate at any desired point. Moreover, a nail driven into a bone can be extracted by gripping it in a vise on the casing of the instrument and projecting the carriage against the bone or body member so that the casing is forced away from the body member carrying the nail with it.

The various elements making up the new instrument are arranged in compact and convenient form and the instrument is operated by means of a motor-driven flexible shaft so that it can be used in any position required for the operations referred to above.

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

Fig. 1 is a plan view of the top of the instrument embodying the present invention;

Fig. 2 is a plan view of the bottom of the instrument;

Fig. 3 is a view in end elevation of the instrument;

Figs. 4 and 5 are views in side elevation of one end of the instrument;

Fig. 6 is a view in longitudinal section taken on line 6—6 of Fig. 1;

Fig. 7 is a view in section taken on line 7—7 of Fig. 1;

Fig. 8 is a view in section taken on line 8—8 of Fig. 1; and

Fig. 9 is a view in section taken on line 9—9 of Fig. 2. The form of the invention chosen for purposes of illustration is especially adapted to be operated by means of

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a power driven, flexible shaft of conventional type. It will be understood, however, that the device may be provided with a self-contained electric motor or other operating means.

As shown in Figs. 1 and 2, the instrument includes a casing 10 having a cylindrical portion 11, and at its opposite end a generally rectangular casing portion 12. The casing sections 11 and 12 are hollow and serve to house a carriage 13 and a drive mechanism 14 for bending, shearing and extracting nails N, shown in dotted lines in Figs. 1, 2, 3, 6 and 8. The carriage 13 is generally cylindrical in cross section as shown in Fig. 3 and has a notch or slot 15 wider than a nail N extending inwardly from its left-hand end, as viewed in Fig. 6. The carriage 13 is received in a semi-cylindrical bore 16 in the generally rectangular block 17 which forms the upper portion of the casing section 12. The block 17 may be integral with or fixed to the casing section 11. The bore 16 is open at its lower side and the open side of the bore is closed by means of a plate 18 secured to the block 17 by means of screws 19, 20 or the like. The carriage 13 has a flat surface on one side which engages the plate 18 and prevents the carriage from rotating.

The carriage 13 is slidable lengthwise of the bore 16 and can be moved in either direction by means of the drive mechanism 14. This mechanism includes a threaded shaft 21 secured to the inner end of the carriage 13 by means of a set screw 22. The shaft 21 is in threaded engagement with a nut-like member 23 within the casing section 11, the member 23 having laterally extending sleeve bearings 24 and 25 which are mounted in the roller bearings 26 and 27 carried within the casing section 11. The nut member 23 also has a worm gear 28 formed around its periphery, this gear meshing with the worm 29 which extends transversely of casing section 11 and has a supporting shaft rotatably mounted in the side walls of a housing 30 extending below the casing section 11. As shown in Figs. 1, 2 and 3, one end of the worm shaft 31 is squared as at 32 for engagement in the chuck or coupling 33 on the end of a flexible shaft which may be driven by a reversible electric motor or the like. Thus, as the shaft 31 is rotated, the threaded member 23 is rotated in one direction or the other and causes the shaft 21 and the carriage 13 to move to the right or the left as may be required.

As shown in Fig. 6, the casing section 11 which houses the drive mechanism 14 may be made up of a generally cup-shaped inner section 34 which receives the bearing 26, an outer cup-shaped section 35 which receives the bearing 27 and a ring member 36 interposed between the cup-shaped sections 34 and 35 and held in assembled relation therewith by means of the screws 37, 38 and so forth. The ring member 36 carries the housing 30 in which the worm 29 is mounted.

Inasmuch as the shaft 21 is relatively long and extends beyond the end of the cup-shaped section 35, the latter may be provided with a tubular extension 39 enclosing and concentric with the shaft 21 and carrying on its outer end a rubber cap or tip 40 which serves as an impactor.

As shown in Fig. 6, a roller 42 is rotatably mounted on a shaft 43 extending across the notch 15 near its upper, outer end. The shaft 43 is supported by the side members 44 and 45 of the carriage on opposite sides of the slot 15. The roller 42 serves as one element of a nail bending brake. The cooperating part of the nail bending brake includes a pair of jaw members 46 and 47 which extend outwardly beyond the left-hand end of the casing section 12 at the underside thereof. The jaw 47 may be formed as an integral part of the plate 18, and as shown in Figs. 1 and 2, is generally L-shaped in plan view to engage the outermost flange at one edge of the nail N. The jaw 46 has an outer end portion which is a mirror image of the jaw portion 47. The jaw 46 is hingedly or pivotally mounted to enable the nail N to be inserted between or removed from the jaws 46 and 47. As shown in Fig. 2, the jaw 46 has a long body portion or arm 48 terminating in a rounded end portion 49 through which a screw 50 extends into the plate 18 to secure the jaw 46 in position with capacity for rocking movement toward and away from the jaw

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47. To relieve the screw 50 of shearing stresses, the arm 48 of the jaw 46 is provided with a notch 51 which receives a lug 52 integral with the plate 18. As shown in Fig. 2, the jaw 46 fits in a complementally shaped recess 53 in the underside of the plate 18.

To enable the jaws 46 and 47 to be brought into close proximity to a body member or a bone in which the nail N is imbedded, the end surfaces of the jaws may be beveled at 55 as shown in Fig. 6.

The jaw 46 may be retained in closed position by means of a bolt or latch member 56 which is slidably mounted in a lateral extension or boss 57 on the side of the casing section 12. The boss 57 may be integral with the casing block 17. The boss abuts against a plate 58 which overlies the top of the casing section 12 and is secured thereto by means of the screws 59. The inner edge of the plate 58 is provided with teeth or serrations 60 for a purpose to be described. The latch or bolt 56 is urged into overlapping relation to the outer edge of the body 48 of the jaw by means of a coil spring 61 mounted in a bore 62 in the boss 57. The end of the bore 62 is covered by the plate 58. The bolt or latch 56 can be retracted by means of a headed pin 63 having its inner end fixed to the bolt and projecting through an elongated slot 64 in the boss 57.

In the operation of the nail bending device, the carriage 13 may be retracted to the position shown in full lines in Fig. 6. The nail N is then gripped between the jaws 46 and 47 so that one part of it extends freely across the open end of the bore 16 in the casing section 12. The upper outer edge of the casing section may be provided with a notch 65 to aid in aligning the nail with the notch or slot 15 in the carriage 13.

The flexible shaft 33 is then set into operation in a direction to move the carriage 13 to the left as viewed in Fig. 6. The carriage advances slowly because of the gear reduction afforded by the drive mechanism 14 and the roller 42 engages the inner face of the nail and forces the nail over the inner edges of the jaws 46 and 47 which serve as a bending fulcrum. The nail can be bent almost 90° depending upon the spacing between the undersurface of the roller 42 and the upper surface of the jaws 46 and 47. Thereafter the direction of the motor or the flexible shaft can be reversed and the roller backed off to free it from engagement with the nail N. The latch or bolt 56 may then be retracted to release the jaw 46, thereby releasing the nail N. Swinging movement of the jaw 46 may be facilitated by means of a spring 66 mounted in an inclined bore 67 in the plate 18 and bearing against the inner edge of the arm 48 adjacent to the notch 51.

The instrument is also constructed and arranged to cut the nails N. As shown in Figs. 1, 2, 6 and 8, the top of the casing section 12 is provided with an opening 70 and the bottom plate 18 is provided with a smaller opening 71 which fits the nail N closely. The opening 70 may be of the same size as the opening 71 although its size is not important, as long as it is large enough to receive the nail N.

The under surface of the carriage 13 is provided with a recess 72 having a shoulder 72a to engage the back 73 of a shear blade 74 which has a triangular shearing portion 75 provided with beveled cutting edges 76. As shown in Figs. 6 to 8 the shear blade 74 rests on the upper surface of the plate 18 so that as the shear blade advances from the full line position shown in Fig. 6 to the dotted line position, it will punch and cut the nail at a plane at the upper surface of the plate 18. The power developed even with a small motor is sufficient to shear a heavy nail formed of stainless steel and the like because of the great gear reduction provided in the drive mechanism 14.

The carriage 13 may also be used for extracting a nail which has been driven into a bone. To this end, the upper surface or top of the casing member 12 is provided with a pivoted jaw or vise element 77 which is supported at its inner end by means of the screw 78. The jaw member 77 has one or more teeth 79 thereon opposing the teeth 60 on the plate 58. The plate 58 and the member 77 form the jaws of a vise which can be forced together to grip a nail N as shown in dotted lines in Fig. 1. The jaw 77 may be held in closed position by means of a pivoted lever 80 supported on the side of the casing section 12 by means of the screw 81. The lever 80 has a camming surface 82 engageable with the outer edge of the jaw 77 and an extended arm

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83 provided with a knob 84 by means of which considerable force can be exerted to close the jaws 77 and 60.

With the nail end gripped between the jaws 77 and 58, the carriage 13 may be projected beyond the outer ends of the jaws 46 and 47 to engage the bone or body member into which the nail has been inserted. As the carriage 13 advances, it forces the casing 10 and the nail affixed to it away from the body member so that the nail is fully or partially withdrawn.

The shaft 21 is long enough to enable a substantial projection of the carriage beyond the outer ends of the jaws 46 and 47 so that the nail may be drawn out a substantial distance without the need for releasing and reengaging the nail repeatedly during the extracting operation.

Opening of the jaw 46 may be facilitated by means of a pin 84 thereon which extends into a slot 85 in the top of the casing section 12 and is engaged by a coil spring 86 in the slot as shown in Figs. 1 and 7.

The instrument described above may form one unit of a kit of instruments which may be driven by the flexible shaft referred to above. It is made of a convenient size for manipulation and of materials such as stainless steel which are resistant to oxidation or rusting and which may be sterilized like any other surgical instrument. The instrument may be readily disassembled for cleaning with a minimum number of tools and a minimum amount of skill.

It will be understood that the instrument is susceptible to variation in size and appearance and that it may be readily adapted to receive nails, nail plates and the like of various sizes by suitably shaping the jaws of the instrument and varying their spacing. Therefore, the instrument disclosed herein should be considered as illustrative of the invention and not as limiting the scope of the following claims.

I claim:

1. A device for bending bone nails, plates and the like comprising a hollow casing, a carriage slidably mounted in said casing for movement lengthwise therein, a pair of relatively movable holding jaws at one end of said casing, means to move said jaws relatively toward each other to grip and releasably hold an article to be bent with a portion of the article projecting from said jaws transversely across the end of said casing and substantially perpendicular to the direction of movement of said carriage and in its path, and means to move said carriage toward said jaws to engage the outer end of said carriage with said portion to bend the latter away from said end of said casing and relative to the portion held by said jaws.

2. A device for bending bone nails, plates and the like comprising a hollow casing, a carriage slidably mounted in said casing for movement lengthwise therein, a pair of relatively movable holding jaws at one end of said casing to grip and releasably hold an article to be bent with a portion of the article projecting from said jaws transversely across the end of said casing and substantially perpendicular to the direction of movement of said carriage and in its path, pivot means connecting one of said jaws to said casing for relative pivoting movement to engage and release said article, a releasable latch to hold the last-mentioned jaw in engagement with said article, and means to move said carriage toward said jaws to engage the outer end of said carriage with said portion to bend the latter away from said end of said casing and relative to the portion held by said jaws.

3. A device for cutting and bending bone nails, plates and the like comprising a hollow casing, a carriage slidably mounted in said casing for movement lengthwise therein, a pair of relatively movable holding jaws at one end of said casing to grip and releasably hold an article to be bent with a portion of the article projecting from said jaws transversely across the end of said casing and substantially perpendicular to the direction of movement of said carriage and in its path, means to move said carriage toward said jaws to engage the outer end of said carriage with said portion to bend the latter away from said end of said casing and relative to the portion held by said jaws, an opening through said casing substantially perpendicular to the path of said carriage to receive an article to be cut, said carriage also having an elongated opening therethrough extending lengthwise of said carriage to receive said article freely, and a shear blade on said carriage at one end of said elongated opening,

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said shear blade being movable with said carriage to cut an article extending through said openings.

4. A device for bending bone nails, nail plates and the like comprising an elongated hollow casing, a carriage slidably mounted in said casing for movement lengthwise thereof, a pair of relatively movable jaws at one end of said casing, said jaws being offset with respect to said carriage to grip and hold a portion of an article to be bent with a free portion of the article extending across said one end of said casing substantially perpendicular to the direction of movement of said carriage, an abutment member on one end of said carriage engageable with the free portion of said article, and means to move said carriage toward said jaws to engage said abutment member with said free portion and thereby bend the latter away from said end of said casing relative to the portion held by said jaws.

5. A device for bending bone nails, nail plates and the like comprising an elongated hollow casing, a carriage slidably mounted in said casing for movement lengthwise thereof, a pair of relatively movable jaws at one end of said casing, said jaws being offset with respect to said carriage to grip and hold a portion of an article to be bent with a free portion of the article extending across said one end of said casing substantially perpendicular to the direction of movement of said carriage, an abutment member on one end of said carriage engageable with the free portion of said article to bend said free portion away from said end of said casing and relative to portion held by said jaws when said carriage is moved, a threaded shaft fixed to and extending from said carriage lengthwise of said casing, threaded means rotatably mounted in said casing engaging said shaft to advance and retract it, and a power-driven member to rotate said threaded means.

6. A device for cutting and bending bone nails, nail plates and the like comprising an elongated hollow casing, a carriage slidably mounted in said casing for movement lengthwise thereof, a pair of relatively movable jaws at one end of said casing, said jaws being offset with respect to said carriage to grip and hold a portion of an article to be bent with a free portion of the article extending across said one end of said casing substantially

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perpendicular to the path of said carriage, an abutment member on one end of said carriage engageable with the free portion of said article to bend said free portion away from said end of said casing and relative to the portion held by said jaws when said carriage is moved, a shear member mounted on said carriage for movement therewith, means on said casing to receive and hold an article to be cut in the path of said shear member, and means to move said carriage lengthwise of said casing.

7. A device for cutting and bending bone nails, nail plates and the like comprising an elongated hollow casing, a carriage slidably mounted in said casing for movement lengthwise thereof, a pair of relatively movable jaws at one end of said casing, said jaws being offset with respect to said carriage to grip and hold a portion of an article to be bent with a free portion of the article extending across said one end of said casing substantially perpendicular to the path of said carriage, an abutment member on one end of said carriage engageable with the free portion of said article to bend said free portion away from said one end of said casing and relative to the portion held by said jaws when said carriage is moved, an opening through said casing to receive an article to be cut, said carriage also having a slot extending lengthwise thereof to receive said article freely, a shear member fixed to said carriage adjacent to one end of said slot to engage and cut the article extending through said opening and slot, and power means to move said carriage lengthwise of said casing.

8. The device set forth in claim 4 including a manually operated vise on the casing adjacent to its said one end to grip a nail driven into a body member, said carriage being movable into engagement with said body member to exert pressure thereagainst and move said casing and vise to withdraw said nail from said body member.

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