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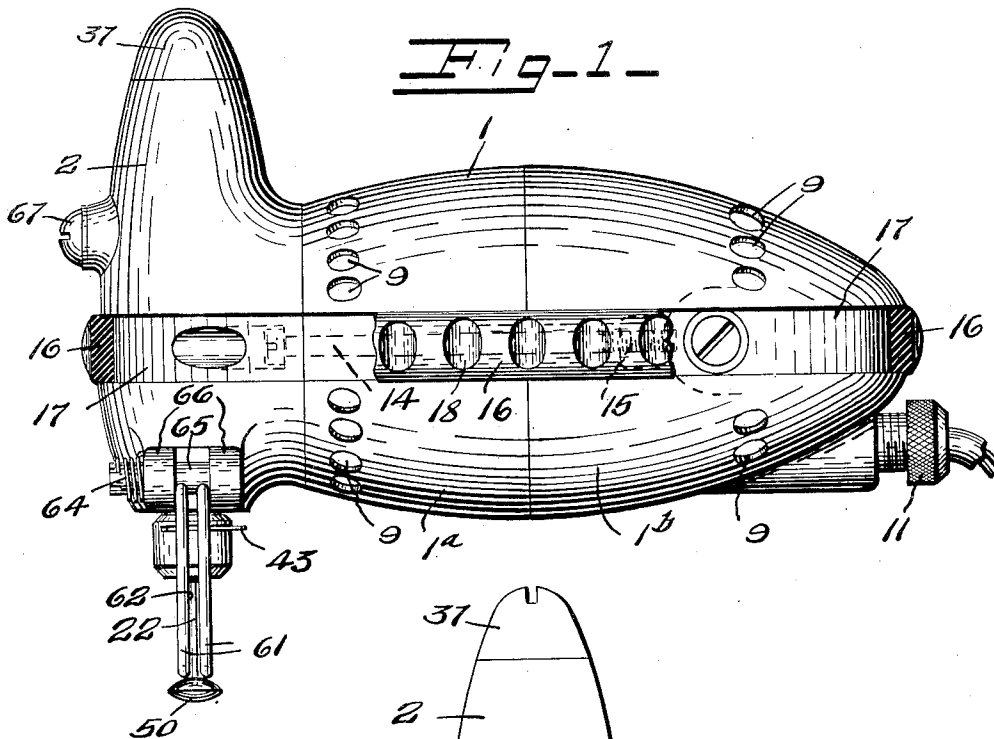
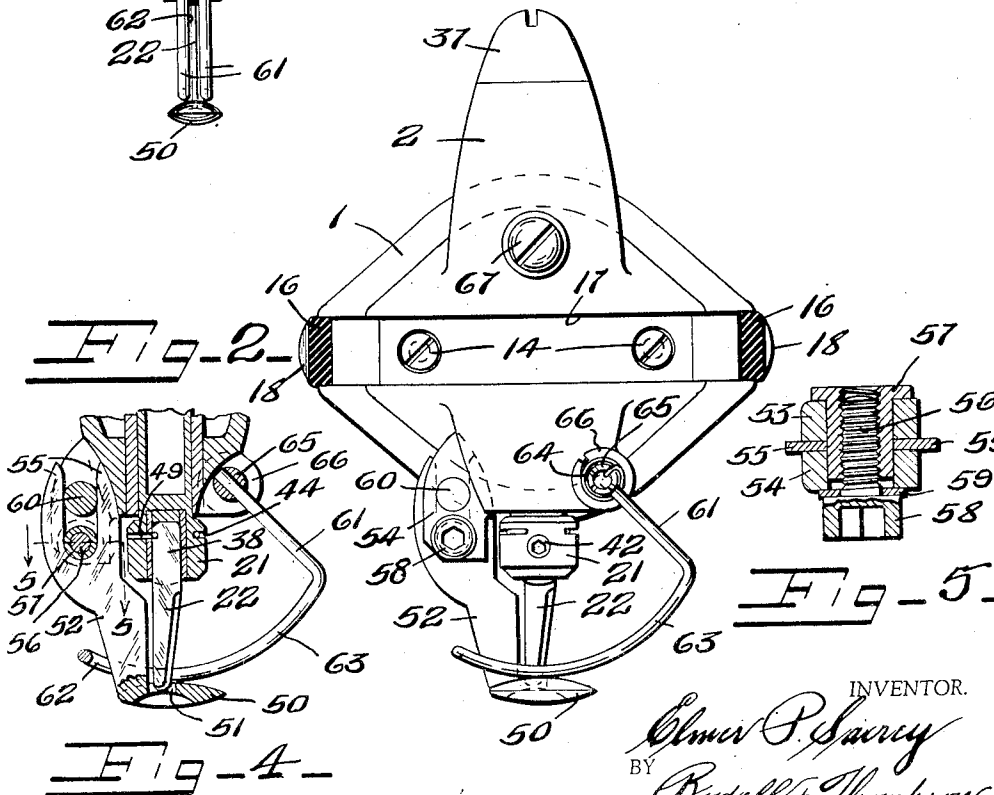
E. P. SACREY

2,015,535

CUTTING INSTRUMENT

Filed March 31, 1934

2 Sheets-Sheet 1



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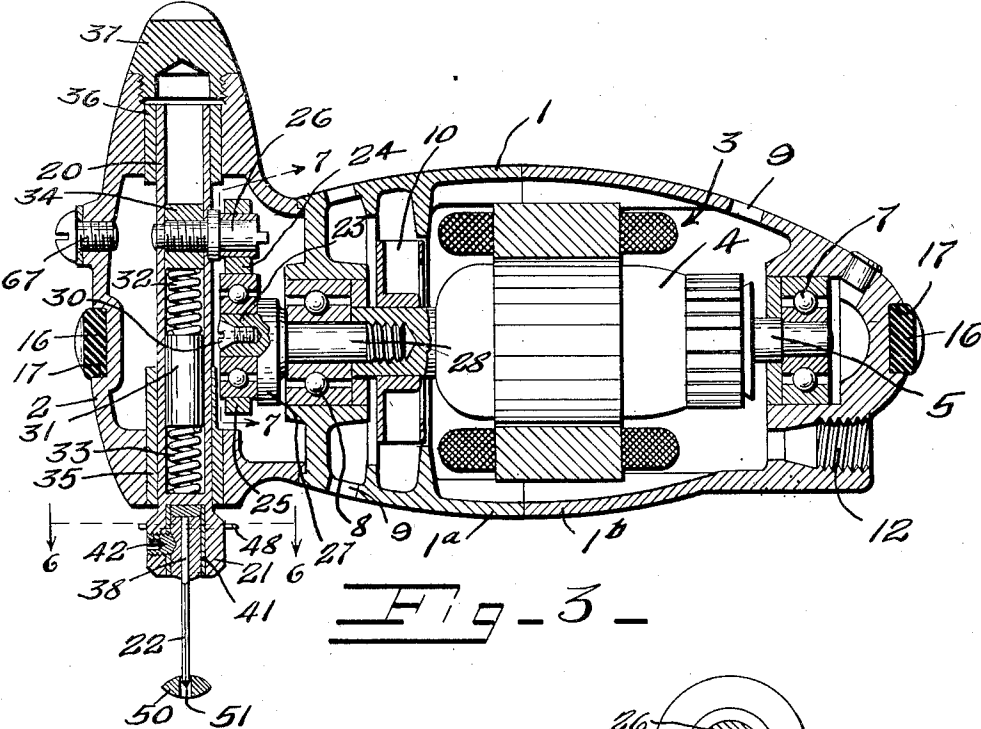
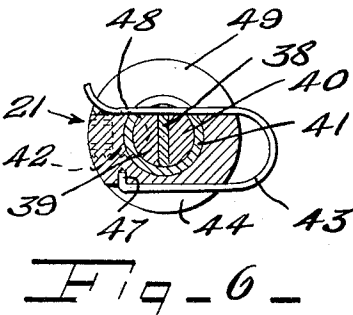
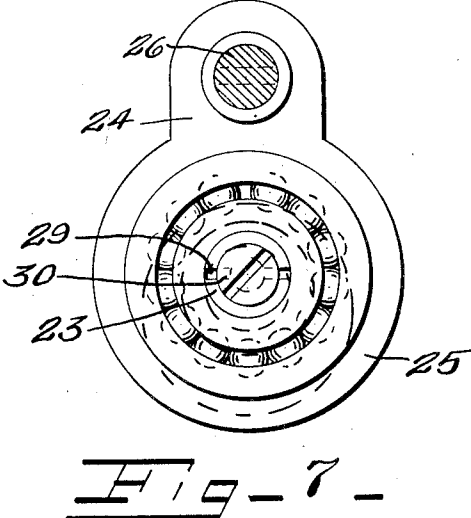
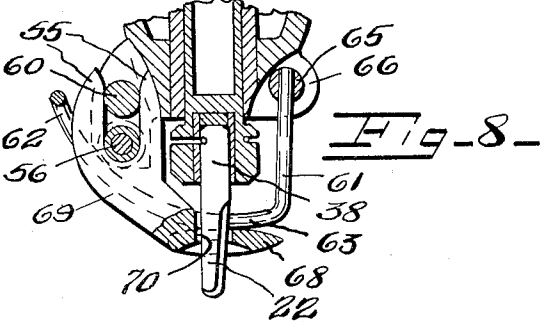
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CUTTING INSTRUMENT

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2 Sheets-Sheet 2



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CUTTING INSTRUMENT

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14 Claims. (Cl. 128—317)

This invention relates to cutting instruments in which the cutter is actuated at high speed and particularly to instruments which are held in the hand while operating, although some of the features are equally applicable to cutters carried by stationary bodies or mounted in fixed supports and the work fed thereto; and more especially has for its object an instrument particularly adapted for use by physicians and surgeons for cutting casts from broken limbs and the like.

It further has for its object a cutting instrument having a reversely-movable tool holder together with means for neutralizing or balancing the vibrations due to the rapid reversals of the tool holder, and further a balancer which consists of a weight or inert element movable or self-contained with the tool holder and also relatively thereto and acted upon in opposite directions by springs which partake of the movement, that is, the reciprocating movement of the tool holder.

It further has for its object a particularly simple and efficient guard for the cutter which is automatically operated by the feeding of the work to the cutter or the cutter to the work, and formed with a slot through which the cutter works.

It further has for its object a cutting instrument having a foot which passes under the work, the foot being provided with a passage or recess in which the end of the reciprocating cutter extends. It also has for its object the relative arrangement of a guard for the cutter and the foot.

It further has for its object the relative arrangement of an electric motor and a reciprocating tool holder in a body for the tool holder and the motor with the motor arranged with its axis extending lengthwise of the portion of the hollow body that serves as a handle.

Other objects will appear throughout the specification.

The invention consists in the novel features and in the combinations and constructions hereinafter set forth and claimed.

In describing this invention, reference is had to the accompanying drawings in which like characters designate corresponding parts in all the views.

Figure 1 is a side elevation, partly in section, of a cast cutting instrument embodying my invention.

Figure 2 is an end elevation, partly in section, looking to the right in Figure 1.

Figure 3 is a longitudinal sectional view taken centrally of Figure 2.

Figure 4 is a fragmentary sectional view of the lower end of the tool holder and contiguous parts

showing the reciprocating knife, the guard and their relation to each other and the foot which moves under the work or cast being cut.

Figure 5 is an enlarged sectional view on line 5—5, Figure 4.

Figure 6 is an enlarged sectional view on line 6—6, Figure 3.

Figure 7 is an enlarged sectional view on line 7—7, Figure 3.

Figure 8 is a view similar to Figure 4 illustrating another arrangement of the foot used when cutting so-called windows in casts.

In the illustrated embodiment of my invention, the cutting implement comprises, generally, a suitable body having a hollow handle portion in which an electric motor is mounted with its axis extending lengthwise of the handle portion and a head at one end of the body arranged with its axis at an angle to the handle portion in which head a reciprocating tool holder is mounted, and motion transmitting means located in the head between the rotor of the motor and the reciprocating tool holder to transmit the rotary motion into a reciprocating motion.

1 designates the handle portion of the hollow body which is here shown as shaped to be readily gripped in the hand.

2 is the hollow head mounted at one end of the handle portion.

3 designates, generally, the motor, and 4 the rotor thereof, the shaft 5 of which is mounted in suitable antifriction bearings 7 and 8 in opposite ends of the handle portion 1. The handle is provided with suitable ventilating openings 9 for the inlet and outlet of cooling air currents created by a fan 10 on the shaft 5 of the rotor 4. The current for the electric motor is supplied through suitable service wires connected to a bushing 11 threading in a passage 12 at one end of the handle portion 1. The handle portion 1 is here illustrated as formed in two sections 1^a and 1^b which abut against each other, and these are secured together and also held assembled with the head 2 by suitable screws, as 14, extending lengthwise of the opposite sides of the handle portion 1, and in a direction crosswise of the head 2, the screws extending through passages in the head and passages in the section 1^a and threading at 15 into the passages of the section 1^b. The body and the head, when assembled, are encircled by a suitable buffer strip 16 of any suitable material, as rubber, this lying in a circumferential groove 17 extending entirely around the body including the handle portion 1 and head 2, and projecting slightly out of the groove. This buffer strip 16

is provided with hand grip surfaces 18 on the portions thereof on opposite sides of the body portion 1.

20 designates the reversely movable tool holder, and that here shown is reciprocally movable axially of the head 2. The tool holder extends beyond one end of the head where it is provided with a chuck head 21 for coupling the cutter or knife 22 to the tool holder.

The motion transmitting means between the rotor or shaft 5 of the motor is located in the head adjacent the path of movement of the tool holder, and as here shown, comprises an eccentric or crank pin 23 at one end of the motor shaft 5, a connecting rod link 24 having a strap 25 encircling the eccentric, the link being pivotally mounted on a laterally extending pin 26 extending from the reciprocating tool holder 20. Preferably an antifriction bearing is interposed between the strap 25 and the eccentric pin 23, this comprising inner and outer raceway rings, one fitted on the strap and the other fitted on the pin and balls between the rings. The pin 23 is provided on a head or disk 27 having a stem 28 threading axially into one end of the shaft 5. One of the rings of the motor antifriction bearing 8 is mounted on this stem 28. The pin 23 is split, as shown at 29 (Figure 7) and a screw 30 threads axially into the split pin, this screw having a conical head and acting as an expander, so that when the screw is tightened, the pin is expanded to tighten into the inner ring of the antifriction bearing.

The vibration balancer means with which the tool holder 20 is provided, comprises a movable inert element or weight 31 here illustrated as slidably mounted in the tool holder 20 to move axially thereof, it being mounted in a tubular portion of the tool holder, and springs 32, 33 reciprocally movable with the tool holder and acting in opposite directions on the weight 31. This vibration balancing weight and springs are interposed between the point where the pin 26 is connected to the tool holder 20 and the projecting end of the tool holder which carries the cutter 22, the pin being located at a point remote from the cutter 22. As here illustrated, the tool holder 20 is for the most part tubular and the pin 26 has a shank extending through the tool holder and a block 34 therein, which block also forms a spring abutment for the spring 32. The spring 33 thrusts against the upper end of the chuck head 21 which is formed integral with the body of the tool holder 20. The tool holder slides in suitable guides or bushings 35 and 36 in the head, the bushing 35 being placed in the head through the lower end thereof, and the bushing 36 through the upper end which is closed by a suitable plug or cap 37.

The cutter 22 is here shown as a knife having a flat shank 38 (see Figure 6) which extends between two jaws 39 and 40 located in a tubular holder 41 fitted in the chuck head 21. The jaws are clamped onto the shank of the knife in any suitable manner, as by means of a set screw or plug 42 threading radially through the chuck head 21 and the tubular holder 41 and thrusting at its inner end against the jaw 39 which presses against the knife shank and thrusts the same against the other jaw 40.

Means is provided for preventing the knife from throwing out in case the set screws 42 loosen, this means being shown as a spring clip or key 43 U-shaped in general form extending transversely of the chuck head 21, one arm of the U forma-

tion seating in a transverse groove at 44 (Figure 6) in the head 21 and having a hook shaped end 47 taking into a depression in the head at the bottom of the groove 44, and the other arm 48 of the U formation extending through a groove 49 in the opposite side of the head 21 and also through grooves or notches in the tube 41, the jaws 39, 40 and the shank of the knife. It is obvious that even if the screw 42 becomes loose or entirely removed, the knife is still locked in the chuck head 21.

50 designates a foot or shield supported from the body or the head 2 and extending under the end of the knife, this having a recess or a passage 51 in which the end of the knife is housed 15 or protected. The end of the knife never moves out of or above the upper surface of the shoe. The shoe is supported from the head 2 in any suitable manner, as by a bracket or arm 52 extending upwardly from the foot in the rear of 20 the knife and in line with the knife or cutter 21. The arm 52, here shown, is secured to the head 2 by being clamped between opposite sections of a split bearing or lug formed on the lower end of the head 2 and constituting oppos- 25 ing jaws 53, 54. The upper end of the bracket is bifurcated, and the bifurcations 55 thereof extend between the jaws 53, 54. The jaws 53, 54 are clamped together by suitable clamping means, here shown, as a screw 56, threading into 30 a nut 57. The nut has a hollow shank or plug portion extending through a suitable opening in the jaws 53, 54 and between the bifurcations 55, the nut thrusting against the outer face of the jaw 53. The head 58 of the screw thrusts through 35 a suitable lock washer 59 against the outer face of the jaw 54. A pin 60 extends transversely of the jaws 53, 54 above the clamping screw 56 and nut 57 and between the bifurcations 55 to hold the arm 52 from pivotal movement, or rigid with 40 the head 2. This pin 60 is merely a rivet. The foot 50 moves under the work or the cast being cut and over the surface of the limb of a patient to which the cast is applied.

61 designates a guard for preventing accidental 45 cutting of the fingers, etc., when the tool is idle or being held in the hand. This guard moves over and close to the upper surface of the foot 50 and is formed with a slot 62 through which the knife works. The guard is shifted by the 50 work when the tool is manipulated to feed the knife into the work. In cutting instruments, the guards usually move downwardly and rearwardly, as the work is fed therinto, and such guards normally shield or cover the edge of the cutting 55 tool.

In this instrument, as the foot slides over the surface of the limb, the guard can not pass below the foot or the lower end of the knife, and hence one of the principal features of this in- 60 vention, is a guard for the knife which is so mounted and constructed as not to pass below the lower end of the cutter or knife. One of the features lending itself to this operation is the slot in the guard in which the knife works. 65

The guard is here shown as pivoted to the head above and in advance of the knife and includes a radial portion or arm and an arcuate portion 63 which during the shifting of the guard about its pivot swings over and close to the upper edge 70 of the foot. The rearward movement of the guard effected by feeding the tool into the work is against the action of a returning spring 64.

As here illustrated, the guard is formed bifurcated in order to provide the slot 62 and the 75

upper end of the bifurcations of the radial portion are fixed to a rock shaft or spindle 65 which is pivotally mounted in ears 66 formed on the lower end of the head 2. The rock shaft is acted upon by the spring 64 which is a coiled spring anchored at one end to the rock shaft and at its other end to one of the ears 66.

The head 2 is formed with an opening for inserting a lubricant into the head, and this opening is normally closed by a plug or screw 67.

Oftentimes, it is desirable to cut so-called windows in casts, that is, to cut a hole in the cast down to the bandages underlying the cast. In order to perform this operation, a foot 68 (Figure 8) is provided carried by a bracket 69 similar to the bracket 52 but shorter than the same in order to support the foot 68 above the lower end of the cutter or knife, so that the knife projects below the foot 68 through a passage 70 therein and cuts below the foot. While cutting, the shoe 68 rides over the surface of the cast and thus locates the knife so that it does not cut too deeply and cut the bandages or the limb of the patient.

Owing to the relative arrangement of the motor, the tool carrier and the motion transmitting means between the motor shaft and the tool carrier, the motor can be mounted in a housing of such small dimensions that the housing for the motor can be used as a handle, making the assembly particularly compact. Owing to the balancing weight 31 the shocks due to the rapid reversals or reciprocations of the tool holder are reduced to a minimum and practically to zero, and owing to the assembly of the balancer or weight and its springs in the reciprocating tool holder, the construction is particularly compact. The foot 50 protects the patient from whom the cast is being cut, from injury by the knife and also serves to lift the portion of the cast about to be engaged by the knife slightly away from the limb while being cut.

Heretofore casts have been cut with knives and oftentimes the patient is inadvertently cut while the physician is cutting the cast. Also, the cutting and removal of a cast with the usual tools requires patience, skill and much time. By this instrument, the operator turns a suitable switch to energize the motor and merely manipulates the tool to insert the foot 50 under one end of the cast with the foot sliding over the limb of the patient and pushes the implement gradually into the cast, the cast pushing the guard rearwardly and upwardly, as it feeds into the cast.

Although I have illustrated the cutting implement for cutting casts, nevertheless, certain features thereof are equally applicable to cutting implements for other purposes.

What I claim is:

1. In a cutting instrument, a body, a reversely-movable tool holder mounted in the body and means for actuating the tool holder, the tool holder having vibration balancing means, in addition to the actuating means, embodied therein and self-contained therewith.

2. In a cutting instrument, a body, a reversely-movable tool holder mounted in the body and means for actuating the tool holder, the tool holder having vibration balancing means, in addition to the actuating means, embodied therein including a weight movable with the tool holder and also movable relatively thereto, and opposing springs interposed between the tool holder

and the weight and acting on the weight in opposite directions.

3. In a cutting instrument, a body, a reversely-movable tool holder mounted in the body and means for actuating the tool holder, the tool holder having vibration balancing means, in addition to the actuating means, embodied therein including a weight movable with the tool holder and also movable relatively thereto, and opposing springs interposed between the tool holder and the weight and acting on the weight in opposite directions, the springs being self-contained with the tool holder.

4. In a cutting instrument, a suitable body, a reciprocating tool holder mounted in the body and means for reciprocating it, a weight slidably mounted relatively to the tool holder and reciprocally movable therewith, and springs carried by the tool holder and acting in opposite axial directions on the sliding weight.

5. In a cutting instrument, a suitable body, a reciprocating tool holder mounted in the body and means for reciprocating it, the tool holder having an axial passage, a weight slidable in said passage and springs located in the passage and thrusting in opposite axial directions against the weight.

6. In a cutting instrument, a suitable body, a reciprocating tool holder mounted in the body and means for reciprocating it, the tool holder carrying the tool at one end and having a laterally extending pin at a point remote from said end to which pin the actuating means is connected, the tool holder having a sliding weight therein between the points at which said pin is connected and the tool support end of the holder, and springs interposed between the tool holder and the weight and acting in opposite axial directions on the weight.

7. In a cutting instrument, a suitable body, a reciprocating tool holder mounted in the body and means for reciprocating it, the tool holder carrying the cutting tool at one end and having a laterally extending pin at a point remote from said end, to which pin the actuating means is connected, the tool holder having a sliding weight therein between the points at which said pin is connected to the holder and the tool supporting end of the holder, and springs interposed between the tool holder and the weight and acting in opposite axial directions on the weight, the weight being axially aligned with the tool holder and the cutting tool being arranged in alinement with the tool holder.

8. In a cutting instrument, the combination with a suitable body, a cutting tool and means for carrying and actuating the tool; of a guard for the tool having a slot through which the tool works, the guard being movably mounted on the body to be shifted by the work being cut, as the work and the tool are shifted relatively to each other to feed the tool into the work.

9. In a cutting instrument, the combination with a suitable body, a cutting tool and means for carrying and actuating the tool, of a guard for the tool having a slot through which the tool works, the guard being movably mounted on the body to be shifted by the work being cut, as the work and tool are shifted relatively to each other to feed the tool into the work, said guard being pivoted to the body above the cutter and extending in front of the cutter and being movable on its pivot by the work pushing against it to permit the work and the cutter to feed one into the other.

10. In a cutting instrument, the combination with a suitable body, a cutting tool and means for carrying and actuating the tool; of a guard for the tool having a slot through which the tool works, the guard being movably mounted on the body to be shifted by the work being cut, as the work and the tool are shifted relatively to each other to feed the tool into the work, said guard including a rock arm pivoted to the body above and in front of the cutter and having an arcuate portion through which the cutter works.

11. In a cutting instrument, the combination of a suitable body, a reciprocating tool holder carried by the body and means for reciprocating it, a cutter carried by the tool holder at one end thereof outside of the body, a foot supported from the body and extending under the outer end of the cutter and having a recess housing the lower end of the cutter, and a guard movably carried by the body and having a portion thereof extending over the upper face of the foot and formed with a slot through which the cutter works, said guard being shiftable relatively to the body during the relative feeding of the cutter and the work.

12. In a cutting instrument, the combination of a suitable body, a reciprocating tool holder carried by the body and means for reciprocating it, a cutter tool carried by the tool holder at one end thereof outside of the body, a foot supported from the body and extending under the outer end of

the cutter and having a recess housing the lower end of the cutter, a guard pivoted to the body above and in advance of the cutter and including an arcuate portion movable during the pivotal movement of the guard over the face of the foot and formed with a slot through which the cutter works.

13. In a cutting instrument, the combination of a suitable body, a reciprocating tool holder carried by the body and means for reciprocating it, a cutter carried by the tool holder and extending outside of the body, a foot supported from the body and extending under the outer end of the cutter, a guard carried by the body and having a portion extending over the upper face of the foot and being formed with a slot through which the cutter works, said guard being shiftable toward and from the upper face of the foot, and means tending to move the guard toward the foot.

14. In a cutting instrument, the combination of a suitable body, a reciprocating tool carried by the body, and means for reciprocating it, a cutter carried by the tool holder and extending outside of the body, a foot supported from the body and extending under the outer end of the cutter, said foot having a recess located remotely from the forward end of the foot, whereby the foot acts as a guard for the outer end of the reciprocating cutter.

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