

Jan. 15, 1952

T. F. GUNDLACH

2,582,694

DEVICE FOR SEVERANCE OF RIGID MATERIALS

Filed Feb. 10, 1949

2 SHEETS—SHEET 1

FIG. 1.

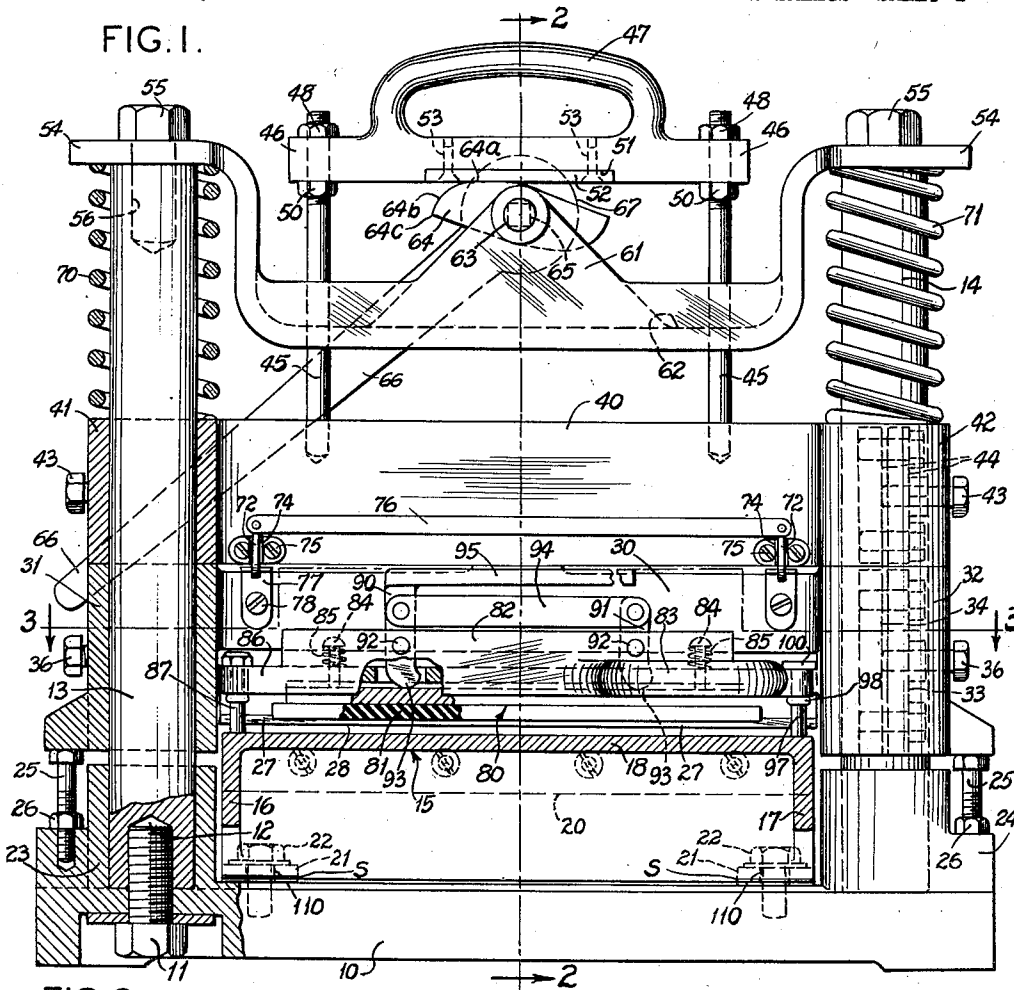
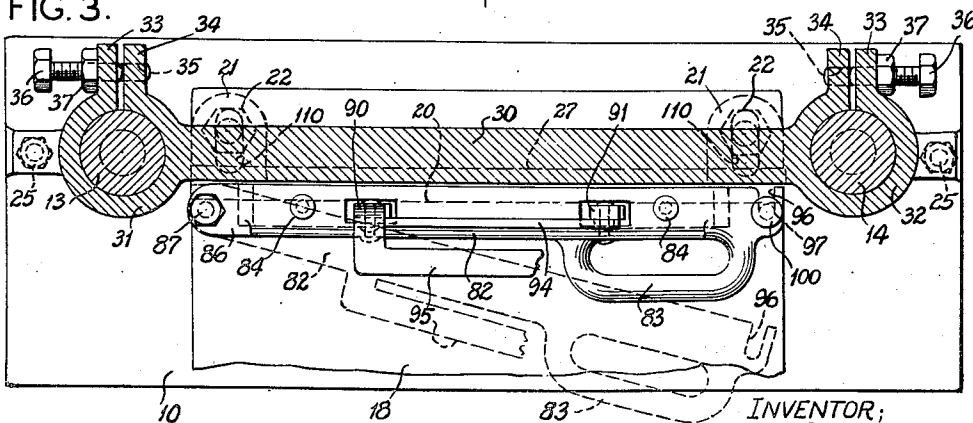


FIG. 3.



INVENTOR;
THEODORE F. GUNDLACH,
BY *Robert B. Terry*
ATTORNEY

Jan. 15, 1952

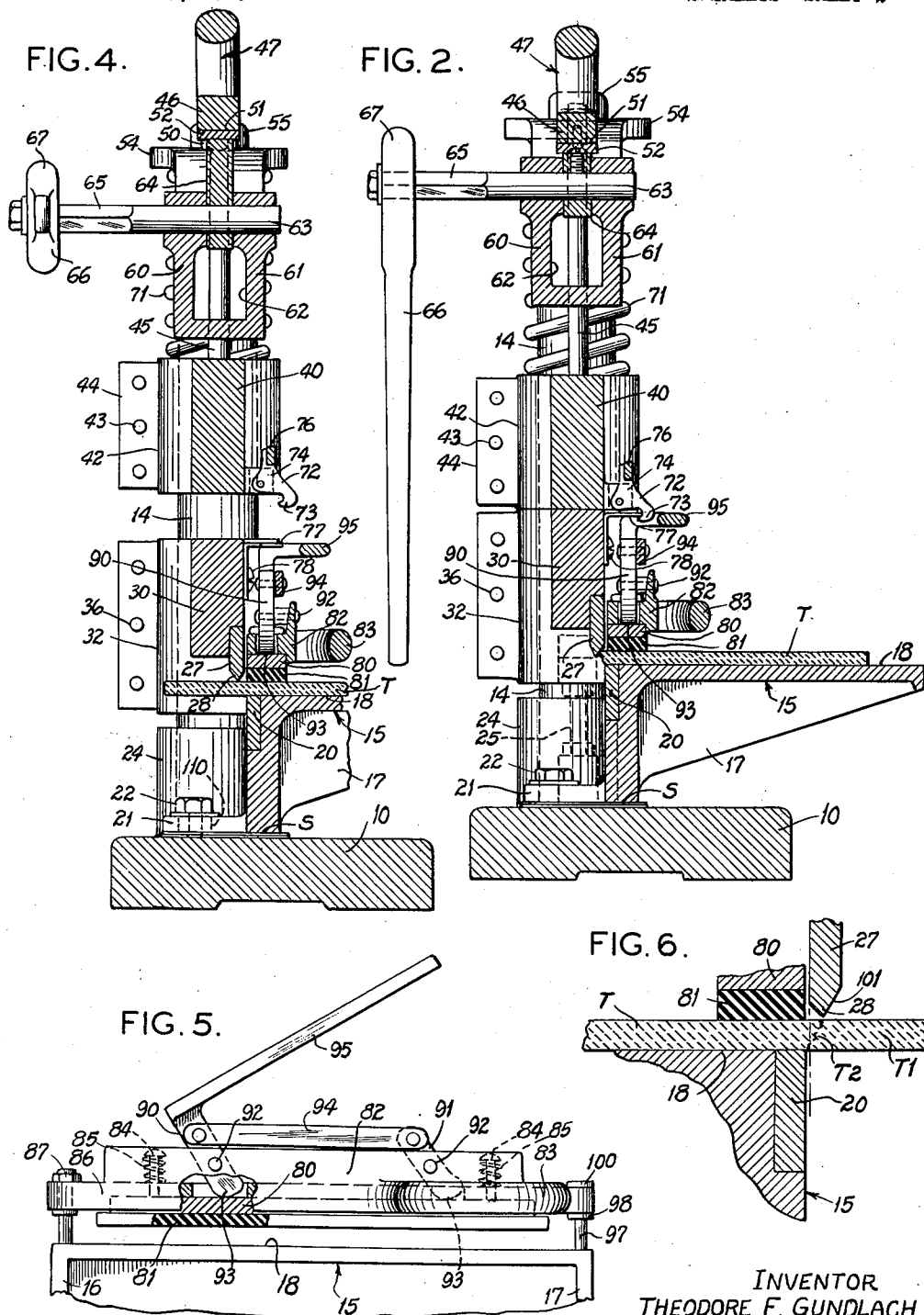
T. F. GUNDLACH

2,582,694

DEVICE FOR SEVERANCE OF RIGID MATERIALS

Filed Feb. 10, 1949

2 SHEETS—SHEET 2



INVENTOR
THEODORE F. GUNDLACH,
BY *Robert B. Terry*
ATTORNEY

UNITED STATES PATENT OFFICE

2,582,694

DEVICE FOR SEVERANCE OF RIGID MATERIALS

Theodore F. Gundlach, Belleville, Ill.

Application February 10, 1949, Serial No. 75,583

10 Claims. (Cl. 125—23)

1

This invention relates to improvements in devices for severance of rigid materials; and more particularly to a reciprocally operated breaking and shearing apparatus adapted for reducing the dimensions of certain sheet and slab materials.

With the advent of certain newer long wearing types of flooring materials of the nature of ceramic tile, there has arisen a need for apparatus which will quickly and cleanly sever certain types of such tile. Among the products of a class particularly difficult and time consuming in severance, there may be mentioned a few types of molded ceramic tile which include, for example, aluminum oxide, quartz or similar substances together with a binder. It is recognized as virtually impossible to effect a clean cut of tile of this type without high breakage losses. Prior to the advent of the improvements described and claimed, it was regarded as necessary to depend entirely on hand tools for varying the dimensions of tile units of this order. It is accordingly, a major and general object of the present invention to realize a quick-acting severance device which operates positively, and with virtually no breakage of tile units.

A further important objective of the invention is realized in a severing device which will dependably produce a desirably beveled margin on the tile or like unit.

Yet another highly valuable attainment of the present invention consists in a device which so severs a rigid tile or like unit, as to result in a coarse or rough edge surface of such nature as to effect a better bond with the usual setting materials employed with the tile.

A further and highly desirable objective is attained in an improved severing device for the general purposes noted, and which operates as an impact cutter or breaker assembly, and is of particular advantage in the sizing of certain brittle covering materials, in which class are included numerous ceramic tiles, and pressed, compressed or manufactured tiles.

Still further advantageous features of the improvements include facilities for adjustment between a bedplate and a base of a device of the order noted; an improved hold-down provision for accurately positioning a tile or like unit incident to severance of a portion thereof; improved adjustment means for stabilizing the path of movement of a reciprocable cutting member with provisions compensating for wear of such a member due to operation along fixed guide elements; an improved cam drive for a cutter ac-

2

noted, and still others which will appear from the description of an advanced embodiment of the invention.

The foregoing and numerous other objects will more clearly appear from the following detailed description of an advanced form of device embodying the current improvements, particularly when considered in connection with the accompanying drawing, in which:

Fig. 1 is a front elevation, partly in section, of a severance unit embodying the present improvements;

Fig. 2 is a vertical sectional view as taken along line 2—2 of Fig. 1;

Fig. 3 is a horizontal sectional elevation as taken along line 3—3 of Fig. 1;

Fig. 4 is a view taken similarly to Fig. 2 but showing a hammer and certain coacting elements in a raised position;

Fig. 5 is a front elevation including a fragmentary sectional portion, of a hold-down clamp preferably utilized with and on the bedplate of the present machine, and

Fig. 6 is a fragmentary enlarged sectional view showing portions of the severance knife, hold-down clamp, bedplate, bedknife and a work piece such as a tile, and particularly showing the operative relations between the severance elements and a work piece.

Referring now by characters of reference to the drawing, the machine as illustrated includes a base generally indicated at 10, which is suitably apertured at its opposite ends to receive assembly screws, one of which is shown at 11, and each of which engages a tapped opening 12 located axially of the lower end of a guide member 13 preferably of circular cross section and which constitutes a vertical guide column, pillar or shaft, a companion guide element being shown at 14, and which is or may be similarly formed.

Carried by the base 10 and between the guides 13 and 14, is a bedplate generally indicated at 15 and including vertical supporting end portions 16 and 17 together with a horizontal bedplate proper, indicated at 18. Secured to the portion 18 is a bedknife 20 (Figs. 2, 4 and 6) which constitutes one of the paired coacting severance elements, the other of which is a reciprocally operated knife to be described. The bedplate structure is secured by a suitable plurality of apertured lugs 21 coacting with hold-down screws 22, in attachment of the bedplate to the base 10. As will later be described, the apertures in lugs or feet 21, are of slotted form, for adjustment purposes.

3

Surrounding the lower ends of the guide elements 13 and 14 are a pair of bosses 23 and 24, each of which is provided with a through aperture or a socket conforming in size and shaping to the lower end of the guide with which it is associated. Outwardly of each boss is a tapped extension which serves to receive a jack screw 25 threaded into the tapped aperture of the member 23 or 24, and provided with a jamb nut 26 enabling the screw to be set with its head at a predetermined height above the bedplate, and thus provide an adjustable stop for the knife and knife carrier, as will appear.

The severance element, herein referred to as a knife, although possessing a breaking function as well as a cutting facility, is indicated at 27, and is provided at its lower end with a horizontal cutting margin or apex 28. The knife 27 is mounted by suitable screws (not shown), and at about the position shown along the lower margin of a knife carrier or block 30 which, as will appear, is reciprocally movable. In the example selected, the knife carrier 30 is guidedly constrained to up-and-down movement in a vertical plane, and for this purpose is provided with integral sleeve or bushing extensions at its opposite ends, as indicated at 31 and 32 and as seen in Fig. 3. The elements 31 and 32 are each provided with a circular bore conformed in initial diameter to the outside diameter of guide posts 13 and 14. However, in order to provide no more than a requisite working clearance between the sleeves and guides, each of the sleeves is peripherally severed and in its severed zone is provided with lateral extensions 33, 34, the latter being provided with a tapped opening 35 to receive an adjusting screw 36 provided with a lock nut 37, the manner of usage of which for adjustment purposes, will now be obvious, it being noted that the parts and arrangement for this adjustment, are identical except preferably reversed, in the two sleeves 31 and 32.

Separate from the knife carrier 30 but vertically reciprocable in the same plane, is a hammer or impact element 40, and which is provided with integral end extensions 41 and 42 in the nature of guide sleeves coaxing with the posts 13 and 14 in a manner similar to or identical with these provisions as described on the knife carrier 30. Similar adjustment provisions on the hammer sleeves include adjusting screws 43 and apertured extensions 44.

Extending upwardly from an intermediate region of the hammer 40 are a pair of vertical lifting studs 45. These may be fitted into suitably tapped apertures (not shown) in the body of the hammer 40. Each of the studs 45 is threaded in its upper region, and receives over its threaded region, apertured end extensions 46 of a handle structure 47, assembly between the studs 43 and the handle or lifting structure 47 being completed through top and bottom nuts 48 and 50 on each stud.

It will hereinafter appear that the lifting structure 47 constitutes, in effect, a follower for a lifting cam on a powershaft, both to be described. As an immediate follower for such cam, the undersurface of the bridge of the structure 47 is recessed as at 51 to receive a wearing insert 52 held in place by screws 53, and which is acted upon directly by the lifting cam, as will appear.

As will best appear from Fig. 1, the upper ends of the guide posts 13 and 14 are bridged by a transverse spacing member or distance piece which includes apertured horizontal ends 54

4

through the openings of which extend hold-down screws 55 extending through tapped apertures 56, only one of which is shown in Fig. 1. The bridge piece, between members 54, is centrally depressed as shown, and this central portion serves to support, on opposite sides of the studs 45, a pair of bearing arms 60 and 61. The center part of the bridge piece is apertured to permit the studs 45 to pass therethrough, as is indicated at 62 (Fig. 4) the bearing arms 60 and 61 being apertured at their upper ends with apertures bushed if desired, to receive in journalling relation a rotatable power shaft 63 which carries between arms 60 and 61, a lifting cam 64 to be described in more detail as to its nature and profile. Shaft 63 is provided beyond the arm 61, with a square end 65 which serves to receive a ratchet wrench 66, and which includes a conventional or other suitable ratcheting device contained within the head 67. This wrench is preferably operatively attached to the squared end 65 of shaft 63, and so forms a more or less permanent actuating member. As will now be evident to those skilled in the art, the head 67 constitutes a unidirectional drive between the handle 66 considered as a crank arm, and shaft 63, with operational advantages, as will appear.

Mounted upon and centered by the guide posts 13 and 14, are a pair of compression springs, each of a relatively heavy loading and identified respectively at 70 and 71. These are preferably end-ground so that their opposite faces abut firmly and evenly against top abutments, one for each spring, provided by the ends 54 of the fixed bridge, the lower ends of the springs having abutment with the top faces of the sleeve portions 41 and 42 at the ends of the hammer assembly 40.

As will later better appear in a discussion of the operation of the device, it is advantageous to provide for a selective latching connection under certain conditions, between the impact element such as hammer 40, and the knife carrier 30. Such a provision in the present assembly consists of a pair of spaced latches 72. These may be in the nature of a latch more or less prevalently known in the trade as a cabinet latch. Each latch consists of an L-shape arm with a hook or latch end 73 (Fig. 4) and each is pivotally spaced between ears 74 of a supporting base structure secured to the hammer 40 as by screws 75. The latch levers 72 are interconnected by a cross bar 76, so as to compel them to operate together, whether such movement be into latched or unlatching position. The coaxing keeper element of each of the paired latches consists of a small flanged piece 77 secured as by a screw 78, to the knife carrier 30. From the foregoing it will appear that optionally, and automatically under certain conditions, the latch mechanism 72—72 will serve operatively to connect together, the knife carrier 30 and the hammer 40.

It has been found desirable, particularly in the severance of units of tile of a relatively brittle material, to employ a hold-down clamp of a type which will frictionally grip, and yet resiliently keep in place, the work piece being acted upon for severance, as in sizing. A suitable such device includes a normally horizontal platen 80 to which is bonded or otherwise secured on its undersurface, a layer of material which is highly compressively resilient, for example a sheet of sponge rubber or comparable synthetic, indicated at 81. Above the platen 80 is a swingable supporting element 82, one end of which carries a handle 83. The platen 80 carries a pair of spaced, rigid,

headed pins 84, each such pin carrying a light compression coil spring 85, the supporting element 82 being apertured to pass the pins 84, so that the latter, with the springs, serve floatingly to support the platen 80. The supporting element 82, as will appear, is in the form of a gate including a hinge arm 86 apertured to receive a vertical hinge pin 87, carried by the bedplate structure 15.

For selective actuation of the platen between clamping and releasing positions with respect to a tile or like work piece indicated at T, the support 82 is of a partly furcate construction as will appear from Figs. 2 and 4, and receives between its furcations a pair of rockable cam-like levers 90 and 91. These are operatively identical, each being pivoted as by a through pin 92 to one or both of the furcate portions of the support element 82, and each is provided at its lower end with a rounded camming nose portion 93, acting upon the floating platen 80 to effect a work-engaging movement of the platen against the loading of springs 85. The outer ends of the camming levers 90 and 91 are pivotally interconnected through a link 94, so that both are similarly actuated whenever moved in either direction. The lever 92 is extended somewhat above the link 94, for connection to a rigid handle portion 95 which, as will appear in Fig. 5, is actuated counterclockwise to the position shown to raise the platen and release it from the work piece, and is moved downwardly or clockwise (Fig. 5), to actuate the cam levers about their pivots in the same direction for work-clamping actuation of the platen 80.

It will have appeared that the support 82 is in the form of a gate, and is desirably supported at both ends when in its operative position over the work piece T. To this end, the portion opposite the hinged end, is slotted as shown in dotted lines in Fig. 3, and as indicated at 96. This slotted end, when the gate is closed, hooks over a shoulder 98 on fixed pin 97, which supports the free end of the gate when the latter is in closed position. A companion shoulder, similar to that indicated at 98, may be provided at 100 (Fig. 5) so as definitely to fix the height and horizontal position of the gate when closed.

There have heretofore been described the facilities for adjusting the bottom stop position of the knife and knife carrier, as through the jack screws 25. Somewhat similar facilities for adjustment are preferably provided between the bedplate 15 and the base 10, for purposes of levelling as well as initial height adjustment of the working surface of the table part of the bedplate, with respect to the base. A convenient low-cost provision of this order consists in the utilization of selected numbers and gauges of shims S between the apertured foot portions 21 of the bed plate, and the companion surfaces 10 of the base.

The present machine embodies a departure from usually accepted practice in the severance of sheet materials, in that there is importantly contemplated and practiced with the apparatus described, a cutting action on the work piece such as T, along a line which is horizontally spaced from any subjacent support of the work piece by the work table or bed knife 20. This is best shown by Fig. 6, wherein it will appear that the edge 28 of the knife 27 engages the unit such as a tile, at an appreciable distance outwardly from the cutting edge, being the outermost upper margin of the bed knife 20. This action has been

found, after protracted experiments, to result in a clean cut followed by a clean break, of the part T1 from the part T, which severance takes place along a plane which is a continuation of an outer bevelled face 101 of the knife 27 and which face as will appear, is of somewhat greater extent than the minor bevel at the opposite side of the cutting edge. Furthermore and with distinct advantage in cutting relatively brittle and rigid ceramic tile of the type noted, there results along the bevelled margin resulting from the severance, a roughened face T2. From this it results that as in flooring practice, when tile edges thus bevelled are brought into adjacency, there remains between the edge faces of adjacent tile a space which may be described as of inverted V-shape, and which may be filled with a cementitious substance such as to result in a greatly improved bond over that obtaining with the usual, matched, smooth vertical faces of adjacent tile. It should be noted, however, that experiments indicate the desirability of offsetting the cutting edge 28 from the cutting edge of the bedknife 20, not merely for the purpose of producing the bevelled margin as described, but as being of material advantage in producing a clean severance in a perfectly rectilinear severance zone, without spalling, breakage or other effects which not only mar the appearance of the tile but detract from its utility.

Although the operation of the component parts of the machine is thought to have been apparent from the detailed description of its elements, it may be noted for completeness that the cutting actuation of the knife, derived through the knife carrier 30, is accomplished by rotation of the power shaft 63, acting through cam 64. This cam, it should be noted, is of double-end character, both ends of which are structurally and operatively identical so that a description of each of the ends is equally applicable to the other. With reference to Fig. 1, it will appear that the cam profile is such as to exhibit a face so contoured in the portion 64A as to effect, upon a uniform rate of movement of the shaft 63, a first relatively rapid lift of the hammer 40. Beyond the portion 64A, a more sharply curved area 64B results in a diminishing rate of hammer lift incident to hammer cocking action, and incident to the increasing compression of the hammer loading springs 70 and 71. Beyond the portion 64B, a rather abrupt nose 64C of the cam, engages the follower 52 and as soon as the nose 64C is moved beyond the center of the follower, the springs then being loaded to maximum, the cam moves rapidly away from the follower even if the crank-arm or lever 66 be held to uniform movement. There is thus permitted a sharp unloading movement of the springs 70, 71 to effect a rapid impacting action of the hammer on the knife carrier, the upper face of which is, now obviously, sharply engaged by the lower face of the hammer.

Briefly to review the usual operations in severance of a ceramic tile or similar sheet or slab unit of brittle character, with the knife carrier and hammer lifted at least partly, the hold-down clamp identified with plate 80, is opened to clear the table. This is done, as earlier described, by movement of the handle 95 to bring it to the position shown by Fig. 5, then swinging the gate or support element 82 clockwise about its hinge (Fig. 3). The work piece is placed on the bedplate, having according to usual practice been measured and marked as by a pencil line or score mark, along the zone of severance. The latches 72 are released by unlatching pressure on the bar

7

16, and the knife carrier 30 previously raised by the hammer, is slowly let down to bring the knife edge onto the marked line. The gate 82 is then swung to the full line position (Fig. 3), the handle 95 brought downwardly so as to press the platen firmly over the tile or other piece of work. The machine is now ready for beginning the severing operation. This is effected either by a continuous movement of the crankarm or handle 66 in a clockwise direction (Fig. 1), or by a succession of lifting movements of the handle as permitted by the unidirectional drive between this member and the shaft 63. Such actuation results as before noted, in a first relatively rapid lift of hammer 40, the knife and knife holder remaining in place just over the work. This first stage of movement is followed by a diminishing rate of hammer lift due to the change in cam profile engaging the follower 52. This step is in turn followed by an off-center movement of the cam beyond its nose, so that the springs impel the hammer 40 downwardly with a sudden sharp impact action, resulting first in a severance of the surface portion of the work piece, followed by a breaking action of the deeper portions of the piece. It may here be noted that due to the self-acting nature of the latches 72 the hammer upon descent against the knife holder, will automatically become operatively connected thereto, so as to enable the initial lift of the knife holder to facilitate insertion of the next work piece.

There has heretofore been mentioned the advantage, particularly in the severance of brittle elements, of the horizontal spacing between the coacting edges of the bedknife and the knife 27. It has further been found advantageous to provide for adjustment of the bedplate 15 to vary the horizontal distance between these cutting edges. Such provision is economically provided for by slotting the apertures in the feet 21 of the bedplate structure, where entered by the assembly screws 22. The location and extent of slots for this purpose are indicated by the numeral 110 (Figs. 3 and 4) from which it will appear that by loosening the screws 22, the entire bedplate structure may be moved toward or away from the plane of movement of the knife 27 to achieve this desirable effect. In general it may be noted that with brittle work units, a unit of greater gauge or thickness requires, for best results, a wider spacing of the cutting edges of the bed knife and reciprocal knife.

Although the example described is admirably adapted to work on rigid or brittle materials, many of the features of present improvement are applicable to reciprocal shears and cutters of various types for a wide variety of sheet or slab units.

Although the invention has been described by detailed reference to a preferred embodiment, the detail of description should be understood in an instructive, rather than in any limiting sense, inasmuch as numerous variants are possible within the intended scope of the claims hereunto appended.

I claim as my invention:

1. In an impact type cutting device for producing a bevel margin on relatively brittle sheet and slab materials, a frame, a table serving as a support for a work piece, a knife carried by the table, a reciprocal knife laterally offset from the first knife and arranged to engage the work piece between the knives, an impact element movable to impel the knife, spring means arranged to bias the impact element toward the knife, and a

8

spring loading device operable in a direction first to load the spring and then to release the spring to act upon the impact element and the knife, and means enabling an adjustment of the first said knife toward and from the path of movement of the reciprocable knife.

2. In an impact type cutting device for severance of relatively brittle sheet material to produce a bevelled margin thereon, a reciprocable knife, a bed knife, a spring, a rotatable cam, a camshaft connected to the cam, a cam follower operatively connected with the spring and adapted to act sequentially to load the spring and to release the spring, a hammer element between the spring and knife, arranged to translate the loading of the spring to the first said knife, and latch means detachably connecting the hammer element and the first said knife.

3. In a device for cutting and breaking sheet materials to produce an undercut margin thereon, a reciprocable knife, a normally stationary bed knife, an impact element reciprocably movable to impel the first knife, spring means arranged in coacting relation to the impact element and adapted to move the first said knife in an operating direction, a spring loading device, a work support carrying the bed knife, the bed knife having a cutting and breaking margin parallel to but displaced from the cutting edge of the reciprocable knife, and means enabling an adjustment in horizontal spacing of the edges of the knives when first engaging the material in work.

4. In a cutting and breaking device for rigid, brittle sheet materials, a frame, spaced, vertical guide posts at the sides of the frame, a vertically reciprocable knife guidedly engaging the posts as a movable cross head, an impact element guidably and reciprocably movable along the posts to impel the knife and detachably connectible thereto, a horizontal support for a work piece, spring means acting in a vertical plane against the impact element to move the knife against the work piece, and a device for loading the spring means, the said knife and support being characterized by horizontally spaced, coacting, cutting and breaking edges.

5. The combination with a reciprocable cutter for rigid sheet materials, including a horizontal bed plate and a cutter knife movable across the plane of the bed plate, of a hold-down clamp adapted to position a work piece on the bed plate, said clamp including a platen generally parallel to and normally spaced above the bed plate, a facing of a compressively resilient material on said platen and arranged to engage the work piece, a floating support for the platen, including a swingable supporting member, a plurality of pins carried by the platen, the supporting member being apertured to receive said pins, a spring on each of said pins tending to bias the platen away from the work piece, a hinge through which the supporting member may be moved to and from a position adjacent the work piece, a plurality of cams pivotally carried by the supporting member, said cams being movable to displace the platen into clamping engagement with the work piece, a connection between said cams, and a manual actuating member common to the

6. The combination and arrangement of elements as recited by claim 5, but further characterized in that the bed plate has its work supporting surface substantially in a horizontal plane, and further characterized in that said

swingable supporting member consists of a gate structure swingable about a vertical axis between positions respectively in which the clamp substantially clears the bed plate, and in which the clamp overlies the bed plate and work.

7. In a cutting device of impact type for sheet materials, a frame, a bed plate on the frame, laterally spaced vertical guides on the frame, a knife and knife carrier slidable on the guides, a hammer movably carried by and between the guides, and separable from the knife and knife carrier, springs located to act on the hammer for directing same against the knife carrier, a powershaft, a cam on the power shaft, a cam follower on the hammer, said cam being characterized by a profile presenting a reducing curvature in the direction of its engagement of the follower, followed by a disappearing profile, whereby to result in a decreasing rate of movement of the hammer in a hammer-cocking direction, followed by a quick release of the hammer incident to a continuing actuation of the cam.

8. In an impact type cutting device for severance of relatively brittle sheet material to produce a bevelled margin thereon, a reciprocable knife, a carrier for the reciprocable knife, a bed knife, a work support adjacent the bed knife, a spring, a rotatable cam, a camshaft connected to the cam, a cam follower operatively connected with the spring and adapted to act sequentially to load the spring and to release the spring, a hammer element between the spring and first said knife, arranged to translate the loading of the spring to the carrier, thence to the first said knife, a clamp for positioning the material in work, a support for the clamp swingable about an axis parallel to the plane of movement of the reciprocable knife, and latch means for detachably connecting the hammer element and the carrier for the first said knife.

9. In an impact type cutting device for use on relatively brittle sheet material to produce a bevelled margin thereon, a reciprocable knife, a carrier for said knife reciprocable therewith, a stationary bed knife, a work support adjacent the bed knife, a pair of compression coil springs, a rotatable cam, a camshaft by which the cam is carried, a cam follower operatively connected with the springs, the cam being formed to present a profile for coaction with the cam follower, such as sequentially to effect a relatively slow loading of the springs, and a relatively quick release of the springs, a hammer element between the

springs and the knife carrier, a pair of guide posts on which the hammer and the knife carrier are reciprocably movable and constrained to a straight line of travel, the hammer being arranged to translate the loading of the springs through the carrier and to the said reciprocable knife, the springs being supported by said guide posts just above the said hammer element, and latch means detachably connected to the hammer element and the first said knife.

10. The combination with a reciprocable cutter for rigid sheet materials, including a horizontal bed plate and a cutter knife movable across the plane of the bed plate, of a hold-down clamp adapted to position a work piece on the bed plate, said clamp including a platen generally parallel to and normally spaced above the bed plate, a facing of a compressively resilient material on said platen, and arranged to engage the work piece, a floating support for the platen, including a swingable supporting member, a plurality of pins carried by the platen, the supporting member being apertured to receive said pins, a spring on each of said pins tending to bias the platen away from the work piece, a hinge through which the supporting member may be swingably moved to and from a position adjacent the work piece, quick-acting clamp means carried by the supporting member and movable to displace the platen into clamping engagement with the work piece, and including a manual actuating member through which the said clamp means may be actuated to displace the platen into and out of clamping engagement with the work.

THEODORE F. GUNDLACH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
553,352	Ernest	Jan. 29, 1895
806,133	Graham	Dec. 5, 1905
812,973	Barr et al.	Feb. 20, 1906
1,680,805	Schmidt	Aug. 14, 1928
1,807,679	Winkley	June 2, 1931
2,053,043	Patterson	Sept. 1, 1936
2,188,318	Siderits	Jan. 30, 1940
2,205,313	Stahl	June 18, 1940
2,374,436	Kennedy et al.	Apr. 24, 1945
2,490,989	Williams	Dec. 13, 1949