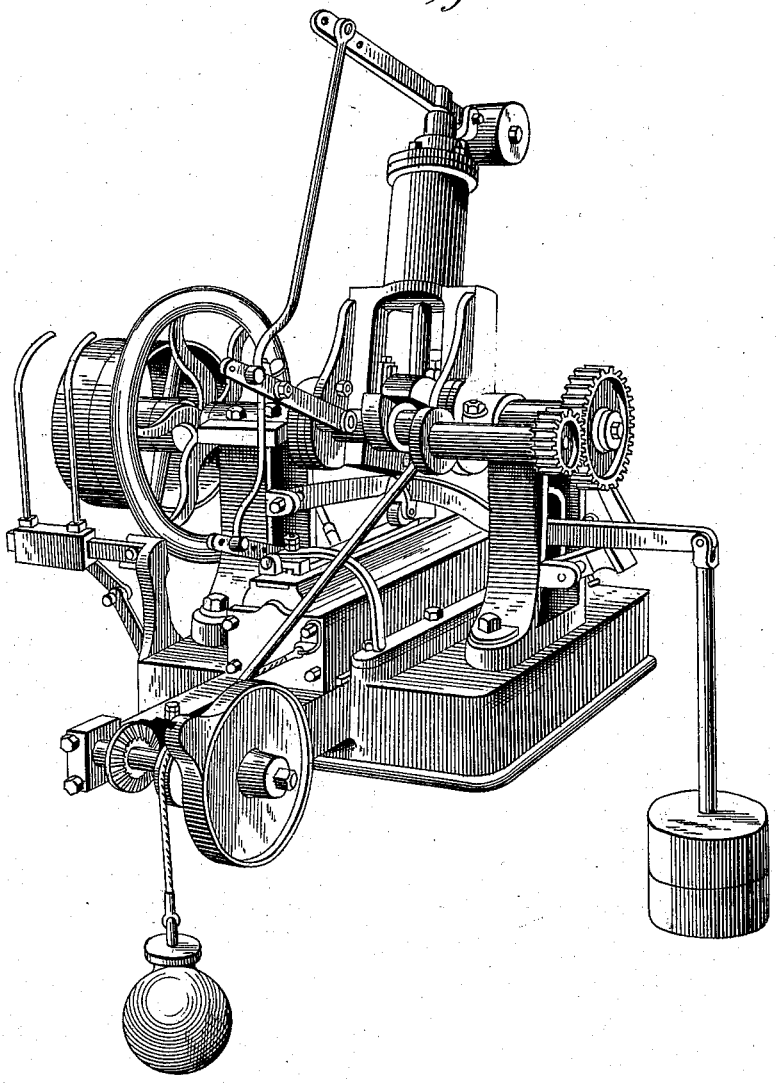
(No Model.) 4 Sheets—Sheet 1.

R. DENISON.

FILE CUTTING MACHINE.

No. 384,133. Patented June 5, 1888.

Fig 1.



Attest:
Walter Donaldson
Chas. L. Stuttevant,

Inventor:
Richard Denison.
by Ellis Spear.
Atty.

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.)

4 Sheets—Sheet 2.

R. DENISON.

FILE CUTTING MACHINE.

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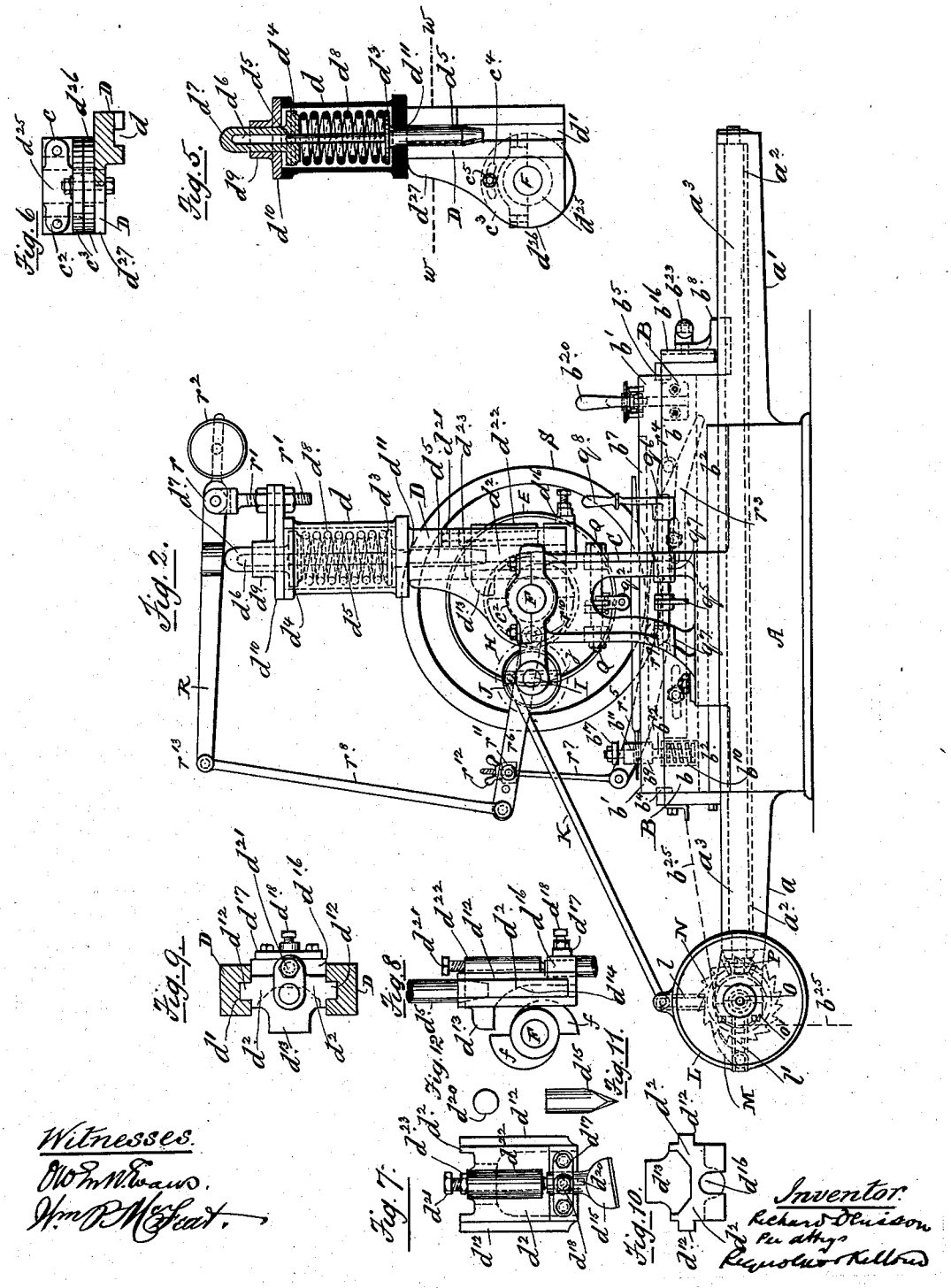

Witnesses.
Otto M. Evans.
Wm. P. McGeat.

Inventor.
Richard Denison
Per attys
Raymond & Kellogg

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 3.

R. DENISON.

FILE CUTTING MACHINE.

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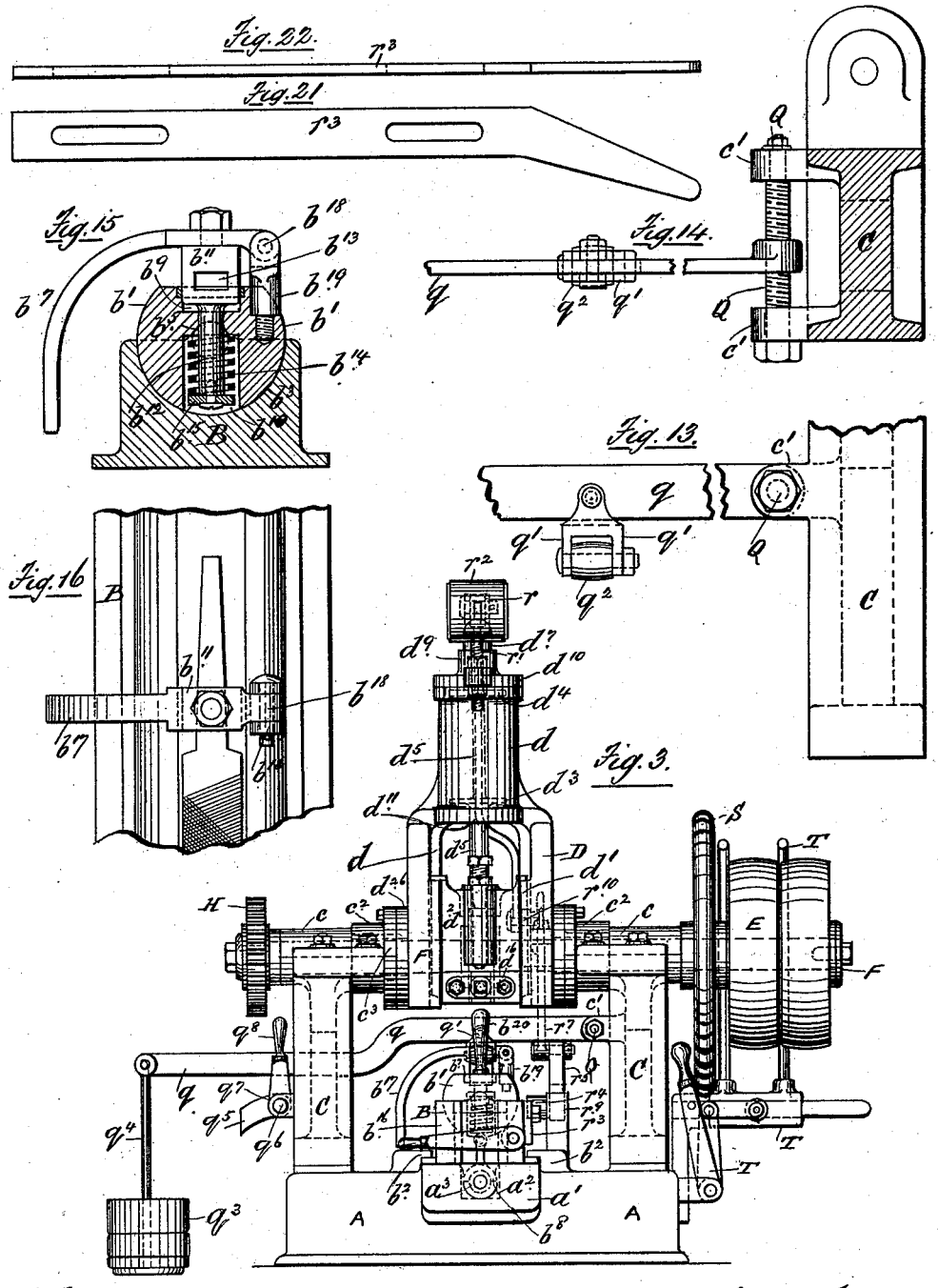

Witnesses.
A. D. W. M. Evans.
Wm. P. M. Seat.

Inventor.
Richard Denison.
Per Atty
Legrelar & Kellogg.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.)

4 Sheets—Sheet 4.

R. DENISON.

FILE CUTTING MACHINE.

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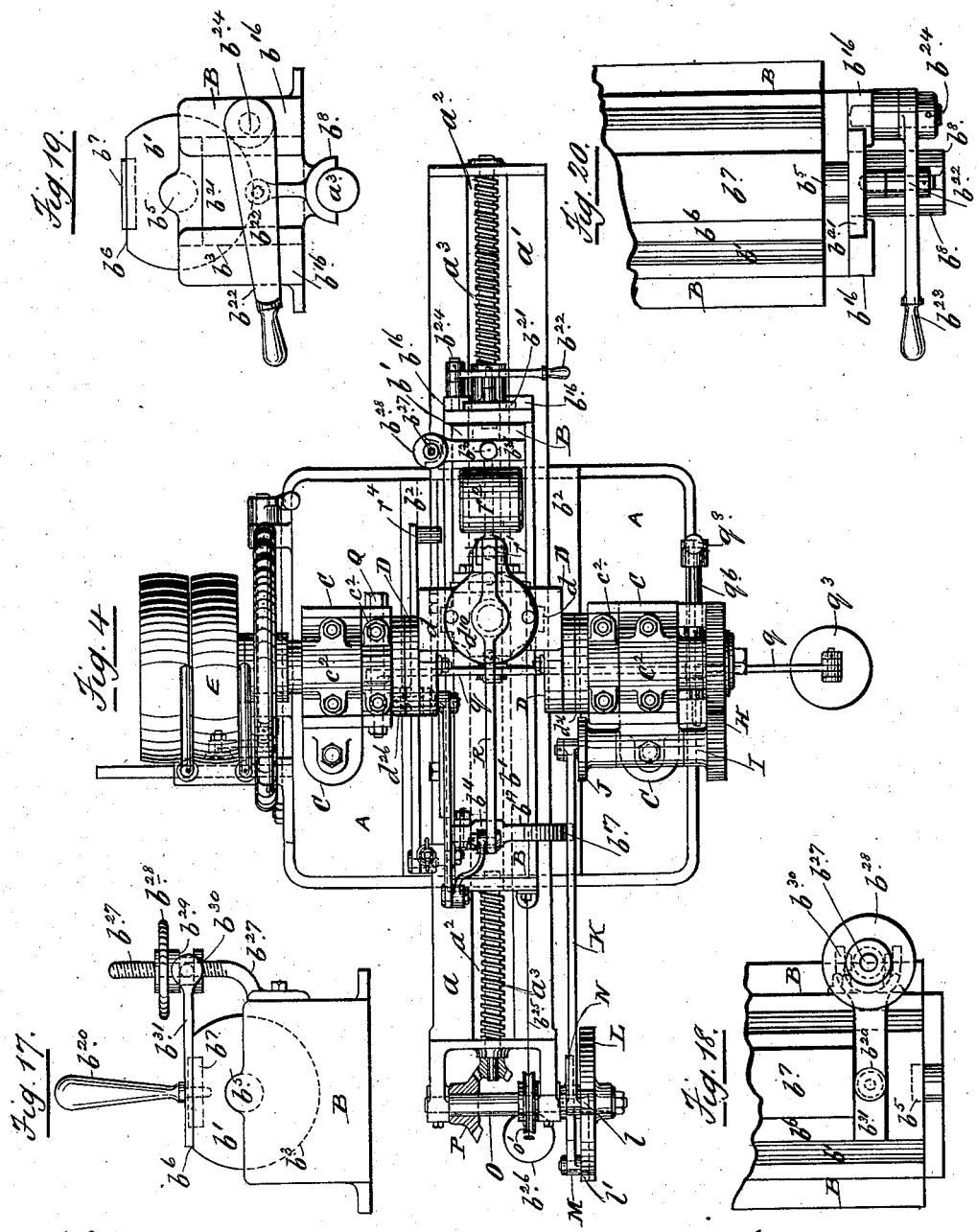

Witnesses:-
H. W. Dunboars.
Wm. B. McFeat.

Inventor.
Richard Denison.
per Atty
Lazelle & Kellond

N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

RICHARD DENISON, OF LEEDS, COUNTY OF YORK, ENGLAND, ASSIGNOR OF ONE-HALF TO JOHN BLAKEY, OF SAME PLACE.

FILE-CUTTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 384,133, dated June 5, 1888.

Application filed February 19, 1887. Serial No. 228,267. (No model.) Patented in England January 2, 1885, No. 62, and May 1, 1886, No. 5,935; in Belgium January 29, 1887, No. 76,138; in France January 29, 1887, No. 181,216; in Germany February 1, 1887, No. 40,936, and in Canada March 10, 1887, No. 26,194.

To all whom it may concern:

Be it known that I, RICHARD DENISON, a subject of the Queen of Great Britain, residing at Leeds, in the county of York, England, have invented new and useful Improvements in File-Cutting Machines, (for which I have obtained a patent in the Dominion of Canada, No. 26,194, bearing date March 10, 1887; in Belgium, No. 76,138, bearing date January 29, 1887; in France, No. 181,216, bearing date January 29, 1887; in Germany, No. 40,936, bearing date February 1, 1887, and for parts of which I have obtained patents in Great Britain, No. 62, bearing date January 2, 1885, and No. 5,935, bearing date May 1, 1886,) of which the following is a specification.

My invention relates to improvements in machines for cutting files and rasps, in which an intermittent reciprocating cutter operates upon a file or rasp blank supported upon an oscillating and horizontal traveling work-supporting bed or anvil, while the said anvil is stationary; and the objects of my improvements are, first, to provide means for holding files and rasps more firmly than hitherto on the bed during the cutting operation by a roller attached loosely to an adjustable and weighted lever arranged to pass over the anvil; second, to arrange for automatically regulating the pressure, whereby the cutting-chisel is brought into operation upon the metal to be cut by means of an arrangement of levers, incline, spiral spring, and pistons, to which the cutter-holder is attached; and, third, to afford facilities for regulating the angle of the tooth or cut of the file by providing means whereby the head of the machine, the cutter-holder, and chisel may be set to cut a tooth straight into the blank or at any required angle up to forty-five degrees. I attain these objects by mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view, Fig. 2 a side elevation, Fig. 3 a front elevation, and Fig. 4 a plan looking at the top, of a file-cutting machine to which my improvements are applied. Figs. 5 are 6 are respectively a sectional elevation and plan on line *w w* of adjustable framing and cylinder containing the pistons and spring for imparting the pressure or force of the blow to the cutting-chisel. Figs. 7, 8, 9, and 10 are respectively front and side elevations and plans of the top and bottom of tool holder or carrier. Figs. 11 and 12 are respectively an end elevation and part plan of cutting tool or chisel. The following views are drawn to a larger scale. Figs. 13 and 14 are respectively a part front elevation and sectional plan of adjustable lever arrangement for holding the file-blank more firmly. Figs. 15 and 16 are respectively a transverse section and part plan of tang-holder. Figs. 17 and 18 are respectively an elevation and part plan of device for setting and holding the oscillating bed in position; Figs. 19 and 20, an elevation and part plan of means for giving motion to the traveling bed. Figs. 21 and 22 are respectively an elevation and plan of incline for actuating pressure-regulating arrangement.

Similar letters refer to similar parts throughout the several views, and the improvements hereinafter described are shown applied to a file-cutting machine to which the chisel-setting and tang-holding arrangements described in my British patent, dated January 2, 1885, No. 62, are also applied.

A is the foundation plate or bed of the machine, having arms *a a'* projecting, respectively, from its opposite ends or sides. In the bed and arms, extending nearly the whole length, is a recess, a^2, in which a feed-screw shaft, a^3, works, carried in bearings formed in the outer end of each arm. On the bed-plate A is mounted centrally over the feed-screw-shaft a movable bed-trough, B, and on each side thereof is bolted to the bed A a standard or upright, C, provided with a bearing, *c*, at its upper end for receiving the trunnions of the adjustable frame D. The movable bed B is made in two pieces, a trough, *b*, and an anvil or block, *b'*, and it is capable of receiving an intermittent horizontal reciprocating as well as an oscillating motion, either simultaneously or independently. The trough *b* is mounted in V or other slides, b^2, formed on or fixed to the bed A, and it is operated by the feed-screw shaft, as hereinafter described. In the top of the trough *b* is formed a long semicircular re-

cess, b^3, for receiving the anvil b', which oscilates on the pins or projections b^4 and b^5. A flat plate, b^6, is formed on and extends the whole length of the periphery of the anvil b'. In this flattened portion is a recess, in which is inserted a bar of lead, b^7, or other suitable material, on which the file rests during the cutting operation. The traversing motion is imparted to the sliding trough b from driving-pulley E, shaft F, spur-gearing H, intermediate shaft, I, disk J, connecting-rod K, plate wheel or disk L, pawl M, ratchet-wheel N, shaft O, carried in bearings formed in the forked end of arm a, bevel-gearing P, mounted on the end of feed-screw shaft a^3, and movable half-nut b^8, which works freely in the slides b^{16} at the end of trough b.

To enable the movable bed-trough b to be thrown in and out of gear with the feed-screw shaft, thereby imparting or arresting the traversing motion, the female portion of the thread is cut in the half-nut b^8, and at one end thereof, at a right angle with the screwed portion, is a plate, b^{21}, which works between the slides b^{16}. To this plate is attached at b^{22} a lever, b^{23}, pivoted to the end of the sliding trough at b^{24}, which is employed for raising or lowering the nut b^8 in or out of gear.

The traverse of the bed B is so arranged that it shall only move the distance of two file-teeth for each revolution of the driving-shaft, and remains stationary while the blow is being struck; and in order to adjust the movement to the varying pitch of file-teeth slots j, l, and l' are respectively provided in the disks J and L, whereby the position of the end of the rod K and pawl N can be regulated as required. As soon as the nut b^8 is withdrawn from the feed-screw shaft, the bed is at once returned to its original position, ready for commencing the cutting operation upon another file-blank, this return motion being effected by a cord, b^{25}, attached at one end to the back of trough b and at the other to a weight, b^{26}, said cord working over a pulley, o', mounted on the intermediate shaft, O.

In order to hold the tang of the file or rasp blank firmly in position during the cutting operation, I employ the device described and illustrated in the specification of my British Letters Patent, dated the 2d day of January, 1885, No. 62, which consists in forming a double recess in the anvil b', as shown at Fig. 15, b^9 and b^{10}. In the rectangular recess b^9 is mounted the holder b^{11}, provided with a projecting pin, b^{12}, which passes through a hole into the lower circular recess, b^{10}. The tang of the file or rasp is passed through a hole, b^{13}, in the head of the holder, and the required downward pressure to hold it tightly in position is obtained by means of a spiral spring, b^{14}, which encircles the pin b^{12}. One end of the spring presses against the top of the recess b^{10}, while the opposite end acts upon a flange, b^{15}, fixed to the end of the pin. For releasing the file from the holder the head b^{11} is fixed to a lever, b^{17}, pivoted at b^{18} to a short pillar or support, b^{19}, which is screwed into the anvil b'. The lever b^{17} is curved downward at its free end to within about an inch of the top of the slides b. To remove the file, the anvil is tilted over or oscillated by the attendant by means of handle b^{20} until the free and curved end of the lever comes in contact with the top of the slide, when by continuing the oscillation the lever b^{17} and head b^{11} are raised and the spring compressed, so that the file can be removed, In some cases, and when preferred, an adjustable incline may be mounted on the top of the slide for acting automatically on the curved end of the lever.

When it is required to fix the anvil b' in any desired position, the device shown at Figs. 17 and 18 is employed, consisting of a screw, b^{27}, bolted at one end to the side of trough b. On this screw works a wheel-nut, b^{28}, provided with a groove, b^{29}, in the periphery of its boss for receiving the pins or studs provided on the forked end b^{30} of a bar, b^{31}, fixed to the anvil b'. It will be readily understood that as the position of the nut b^{28} is raised or lowered on the screw the angle of the anvil will at the same time be altered, and it can thus be set in any desired position.

For the purpose of holding the file-blank firmer than hitherto during the cutting operation a screw, Q, is mounted in suitable bearings, c', on one of the standards or uprights C. This screw passes through one end of a lever or bar, q, placed across the machine, as shown, in which end is cut a screw-thread corresponding with that of the screw, thereby forming a nut whereby the position of the lever q can by turning the screw be regulated or adjusted to the varying angles of the tool-holder. To the lever is hung loosely over the anvil b' a bracket, q', carrying a ball or roller, q^2, rounded on its periphery for working upon the file being cut close to the cutting-chisel. The required pressure is imparted to the ball or roller from the lever q by a weight, q^3, attached to the free end of the lever by a rod, q^4. By rounding the surface of the roller and hanging it loosely on the lever it always retains its position with regard to the cutting-chisel after once being set, thereby insuring a firm and regular pressure being given to the file-blank. When it is required to raise the ball or roller q^2 clear of the work, the short lever or cam q^5, fixed on shaft q^6, carried in bearings q^7, is moved or rotated under lever q by handle q^8 or worm and wheel, thereby raising the roller clear of its work.

In order to regulate the pressure or force of the blow of the cutting-chisel and automatically reduce the same as the cutting operation approaches the end or point of the file or rasp, and also to regulate and adapt the machine to cut the teeth to the required angle, I fix a cylinder, d, to the framing D between the sides or uprights C and over the slides d', in which the cutter-holder d^2 works. Within the cylinder are provided two pistons, d^3 and d^4. The lower piston, d^3, is formed on or attached to the pis-

ton-rod d^5. Above the piston d^3 and within the cylinder the rod d^5 is reduced in size and at its upper end enters a hole, d^6, in the upper piston, d^4. The upper piston is made, by preference, thicker than the lower one, to resist the strain of a spiral spring, d^8, which encircles the smaller portion of the piston-rod interposed between the two pistons, as shown in the drawings. On the upper side of the piston d^4 is a long boss or projection, d^7, which passes through and slides freely in a gland, d^9, formed on the cylinder-lid d^{10}. In the piston d^4 and boss d^7 is formed the hole d^6, extending from the lower face of the piston nearly through the boss. It is employed for receiving and steadying the upper end of the piston-rod. The outer end of the boss d^7 is spherical and works against a weight-lever, to be hereinafter described. The lower and larger portion of the piston-rod issues from the cylinder through a gland, d^{11}, in the bottom of the cylinder, and is colleted or otherwise fixed at the end d^{12} to the sliding tool-holding block d^2.

The chisel and holder I prefer employing are similar to that described in the specification of my British Patent No. 62 of 1885, arranged as follows: The sliding piece d^2 is provided with tenons d^{10} formed on opposite sides of d^2, and which work in the slides d'. Near the top and at the rear of the block d^2 is formed or fixed, so as to be at right angles therewith, a projection, d^{13}, the under surface of which is acted upon by a double cam or tappet, f, (keyed or otherwise fixed to the driving-shaft F, which passes horizontally across the machine and through the trunnions d^{25},) when it is required to impart an intermittent reciprocating motion to the sliding block d^2; and in order to allow for the rotation of the double cam f the block is cut away, as shown at d^{14}. The chisel d^{15} is made with a round shank, which fits in a socket, d^{16}, formed on the sliding block and held in position by means of a retaining-bar, d^{17}, (bolted to the socket,) and set-screw d^{18}. By having the shank of the chisel circular I am enabled to turn it round and set it to any angle across the blank. This angle varies with the different grades of files as well as for the upcut and overcut. When the required angle is once obtained, the chisel is kept thereat by the set-screw d^{18}, the end of which is screwed up tight against a flat portion, d^{20}, formed or cut on the shank. By this means whenever it is required to remove the chisel for grinding or sharpening it can easily and correctly be fixed again to the required angle, thus insuring even and regular work.

In order to prevent the chisel from rising when the blow is struck, and also to set it up as it wears away by the grinding and sharpening operations, a set-screw, d^{21}, is provided, which is screwed into and through the long boss d^{22}. The end of the screw d^{21} works against the end of the chisel-shank, and is locked in position by means of a nut, d^{23}.

To automatically regulate the force or pressure of the blow of the cutting-chisel, the weighted lever R, is fulcrumed at r to the adjustable support r', weighted at r^2, and made to work against the spherical end of the projecting piece of the upper piston, d^4. This lever is employed for compressing the upper piston upon the lower one. The compression is obtained from an adjustable incline, r^3, (attached to the bed-trough, so as to slide with it,) through runner r^4, fulcrumed levers r^5 r^6, and connecting-rods r^7 r^8, as follows: The curved lever r^5 is fulcrumed at r^9 to the uprights or bed of the machine, and on its front end is a pin for carrying the runner r^4, which works against the face of the incline r^3. The rear end of this lever is connected to the second lever, r^6, (fulcrumed at r^{10} to the framing D,) by means of a rod, r^7, the upper end of which is screwed, and after passing through an adjustable projection, r^{11}, on the lever r^6 receives a winged nut, r^{12}, which works against the face of the projection. The rear end of the lever r^6 is connected to the end r^{13} of the weighted lever R by rod r^8. As soon as the incline is traversed forward with the bed-trough and commences to act upon the runner r^4, it thereby raises that end of the lever r^5 and depresses the opposite end, and at the same time, by means of the rods r^7 r^8, the ends of levers r^6 R are drawn downward, whereby the upper piston, d^5, is depressed and the spring compressed upon the lower piston, d^3, thereby increasing the pressure or force of the blow. By cutting a screw-thread upon the rod r^7, I am enabled to increase or diminish the compression of the spring at pleasure without materially altering the position of the curved fulcrumed lever r^5.

The required pressure, above referred to, is conveyed to the slide-block d^2, carrying the chisel through the piston-rod, attached at one end to the lower piston and fixed at the other to the said block, and by allowing the smaller end of the rod to work in the hole d^7 the sliding block and chisel can be raised a fixed height for each blow regardless of the height or position of the upper piston, while at the same time any required degree of pressure can be given by the lever and spring arrangement to the chisel, either independently of or regulated automatically by the movement of the sliding trough b; and in order to set the head of the machine to cut the tooth of the file, either straight into the blank or to any required angle up to forty-five degrees, I provide on the framing D the trunnions d^{25}, which are mounted in the bearings c c. On each side of the frame D is also cast or formed a circular flange, d^{26}, and on each bearing c c is a corresponding flange, c^{11}, one-half of which forms a portion of the cap c^2. In each flange c^3 is a radial slot-hole, c^4, in which is inserted a bolt, c^5, which passes through the flange d^{26} and strengthening-piece d^{27}. It will be readily understood that by carrying the framing D (which supports the cylinder d) in bearings concentric with the axis of the driving-shaft F the angle

of the chisel and parts connected therewith can be varied and fixed by means of the bolts c^5 in any desired position.

S is a fly-wheel mounted on the driving-shaft F, and T belt-fork and lever arrangement for throwing the driving-strap on and off the driving-pulley.

The action of the machine is as follows: The file-blank is placed upon the oscillating work-supporting anvil b' of the traveling bed, which has been previously drawn to the rear end of the machine, and the blank is held in position by the tang-holder b^{11}. When the chisel has been adjusted, as herein described, to the required angles of the tooth, the lever q^3 is lowered, which permits the weighted lever q, carrying the ball or roller q^2, to descend and rest upon the blank. The machine is then set in motion by throwing the belt (by belt-fork arrangement) onto the driving-pulley E, giving motion thereby to shaft H, causing the double cam f to rotate and act upon projection d^{13}, thereby raising the sliding block d^2, which compresses the spring in the cylinder d by means of piston-rod d^5 and lower piston, d^3, against the upper piston, d^4, which is held rigid by weighted lever R and parts connected therewith, while the piston d^3 and rod d^5 are free to be acted upon by cam f. As soon as the heel of the cam passes from under the projection, the spring immediately expands, thereby causing the sliding block and chisel to descend and cut the tooth while the anvil is stationary. The nut b^8 having been geared with the feed-screw a^3, a regular and even traversing motion is imparted to the bed B by means of the spur and bevel wheels, disks, and ratchet arrangement, as herein previously described, and as the bed is traversed forward the incline, acting upon the runner r^4, at once regulates the pressure or force of blow to be given to the chisel. When the blank has been cut, the lever q is raised, the file removed, and another blank inserted. The nut b^8 is then raised from the feed-screw shaft, when the bed B is at once withdrawn to the rear of the machine by the weight b^{26}, and on replacing the nut again the blank is ready for the cutting operation.

Although I have described and illustrated the machine for cutting flat files, I would have it understood that it can be adapted for cutting half-round files and rasps by simply changing the chisel and providing the lead slip with a ledge or projection for preventing the blank from falling off the anvil.

I would here remark that I am aware that it has been previously attempted on several and separate machines to achieve the objects I have in view, and that a bed having an oscillating anvil traversed by a feed-screw, and having an adjustable head or framing with long flat springs acting upon a sliding block carrying the cutter-chisel, has been previously used; also, for regulating the pressure to be given to the chisel, it has been proposed to use a buffer of india-rubbr interposed between the ends of the cutter-holder and a compressing-screw actuated by hand or from a traveling bed through rack and pinion or worm or friction gearing; also, that springs in various forms have been previously used for the same purpose, including a spring arranged within a cylinder or tube compressed by a screw, and constructed so that the end of the piston-rod shall strike the head of a cutting-chisel carried on a separate spindle; also that steam and compressed air have been used; further, that one or more rollers attached to one or more fixed levers have been employed for holding the file down; but to none of these arrangements do I lay any claim when used separately, as no provision is thereby made, so far as I have been able to ascertain, for adjusting the retaining-roller to the varying angles of the cutter so as to enable it to work close to the cutting-chisel, nor is there any provision made whereby two pistons working within a cylinder over a cutting-chisel (carried in or by a holder fixed directly to the piston-rod) can be actuated independently or simultaneously by automatic lever mechanism for compressing a spiral spring by which the force or pressure of the cutting-chisel is regulated.

Having now particularly described and ascertained the nature of my said invention and how the same may be performed, what I claim is—

1. In a file cutting machine, the rectangular tang-holder partially working in a recess in an oscillating work-supporting anvil, said holder being attached at its top to a releasing-lever fulcrumed at one end to the anvil and curved at its free end, while the bottom of the holder is provided with a pin which, after passing through a hole in said recess, is encircled by a spring working in a second recess in the said anvil, substantially as herein set forth.

2. In a file-cutting machine, the combination, with a tang-holder, as herein described, of a work-supporting anvil capable of oscillating on pins during progress of work in a bed-trough adapted to travel in fixed slides on a supporting bed-plate, and mechanism, as described, for connecting said trough with and propelling it from a single shaft, as set forth.

3. In a file-cutting machine, the combination of a work-supporting anvil, traveling bed-trough, and tang-holder with the device for holding and fixing the oscillating anvil in any required position, consisting of a bar secured to top of anvil with forked projecting end fitting a screwed rod secured to trough, and means for raising and lowering such projecting forked end, substantially as herein set forth.

4. The combination, in a file-cutting machine, of the fixed supporting frame or base having a propelling screw-shaft, mechanism for rotating said shaft in a given direction, a bed-trough adapted to travel in slides on said fixed frame, an anvil capable of being oscillated in said trough at any angle during working of machine, a movable half-nut for engag-

ing and disengaging the trough with the screw-shaft, a weight, pulley, shaft, and cord for returning the trough to the rear end of the machine when released from the screw-shaft, the tang-holder, as herein described, and the device for holding the anvil in a given angular position, substantially as described and set forth.

5. In a file-cutting machine, the combination of a work-supporting anvil, a traveling bed-trough, operating mechanism for said trough, and the tang-holding device herein set forth, with a roller attached loosely to a transverse lever, weighted at one end and carried at the other end by an adjusting-screw working in bearings on the side of the machine, whereby horizontal and longitudinal adjustment of the point of pressure on the file-blank, as well as vertical movement, is secured, all as herein set forth.

6. In a file-cutting machine, the combination of a roller attached loosely to a weighted lever, *q*, placed across the anvil and pivoted on an adjusting-screw, Q, carried in bearings on the side of the machine and operating to change horizontally position of lever, and mechanism, substantially as herein described, for raising the roller and lever clear of its work, whereby the position of the roller can be adjusted to the varying angles of the cutting-chisel, substantially as herein set forth.

7. In a file-cutting machine, the combination, with a reciprocating carriage for carrying a file or rasp to be cut, of a cutting chisel or tool having a rounded shank with a flat portion, retaining-bar d^{17}, and set-screw d^{18}, for holding it in position in a U-shaped recess formed in a reciprocating holder in any given angle or position across the blank, substantially as set forth.

8. The combination of cutter d^{15}, holder d^2, cam *f*, for reciprocating same, framing D, provided with slides *d'*, for the reception of the tenons d^{13} on holder d^2, trunnions d^{25}, bearings *c* on standards or uprights C, flanges c^3, slot-holes c^4, and bolts c^5, whereby the cutter can be adapted to cut the teeth of the file to any required angle, as set forth.

9. In a file-cutting machine, the combination of a reciprocating tool-holder carried in an adjustable framing with a cylinder fixed to the said framing directly over the cutter-holder containing a spiral spring interposed between two pistons, the said cutter-holder being attached to the rod of the lower piston, substantially as set forth.

10. In a file-cutting machine, the combination of a reciprocating cutter-holder mounted in slides in adjustable framing provided with trunnions working in bearings formed in the uprights C, the cam on driving-shaft for raising said holder, the cylinder fixed to the adjustable framing over the cutter-slides, the lower piston attached to the said holder by its rod, the upper piston, a spring interposed between the pistons, and the lever mechanism, substantially as described, whereby the upper piston is adapted to compress the said spring onto the lower piston independently of or simultaneously with the upward movement of the tool-holder, whereby the pressure or force of the blow of the cutting-chisel is regulated, as set forth.

11. In a file-cutting machine, the combination of screw-shaft a^3, half-nut b^8, traveling bed B, incline fixed adjustably to such bed, runner r^4 on lever r^5, working against said incline, the levers r^5, r^6, and R, the rods r^7 r^8, the winged nut r^{12}, the cylinder *d*, the adjustable supporting-frame D, upper piston, d^4, spiral spring d^3, and lower piston, d^3, whereby the spring may be compressed independently of or simultaneously with the lower piston, substantially as and for the purposes herein described.

12. In a file-cutting machine, the combination of the fixed bed-plate, screw-shaft, operating mechanism for said shaft, bed-trough adapted to work in slides on said fixed bed A, half-nut whereby it may be engaged with or disengaged from said screw-shaft, a work-supporting anvil adapted to oscillate in said trough, the file-holding devices, substantially as described, the standards or uprights fixed to said fixed bed A, provided with bearings at the upper ends for the reception of the trunnions d^{25} on adjustable framing D, the adjustable framing D, the cylinder *d*, the pressure-regulating mechanism, substantially as described, the tool-holder, cutting-chisel, and cam on driving-shaft, operated as described, whereby the said holder and chisel may be reciprocated and operated for cutting a tooth while the anvil and bed-trough are stationary, substantially as set forth.

In testimony whereof I, the said RICHARD DENISON, have hereunto set my hand to this specification, in the presence of the two subscribing witnesses, at Leeds, in the county of York, England, this 23d day of December, 1886.

RICHARD DENISON.

Witnesses:
W. FAIRBURN HART,
ADAM C. HART.