No. 631,832. Patented Aug. 29, 1899.

G. E. THACKRAY.

METAL SHEARING APPARATUS.

(Application filed May 9, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

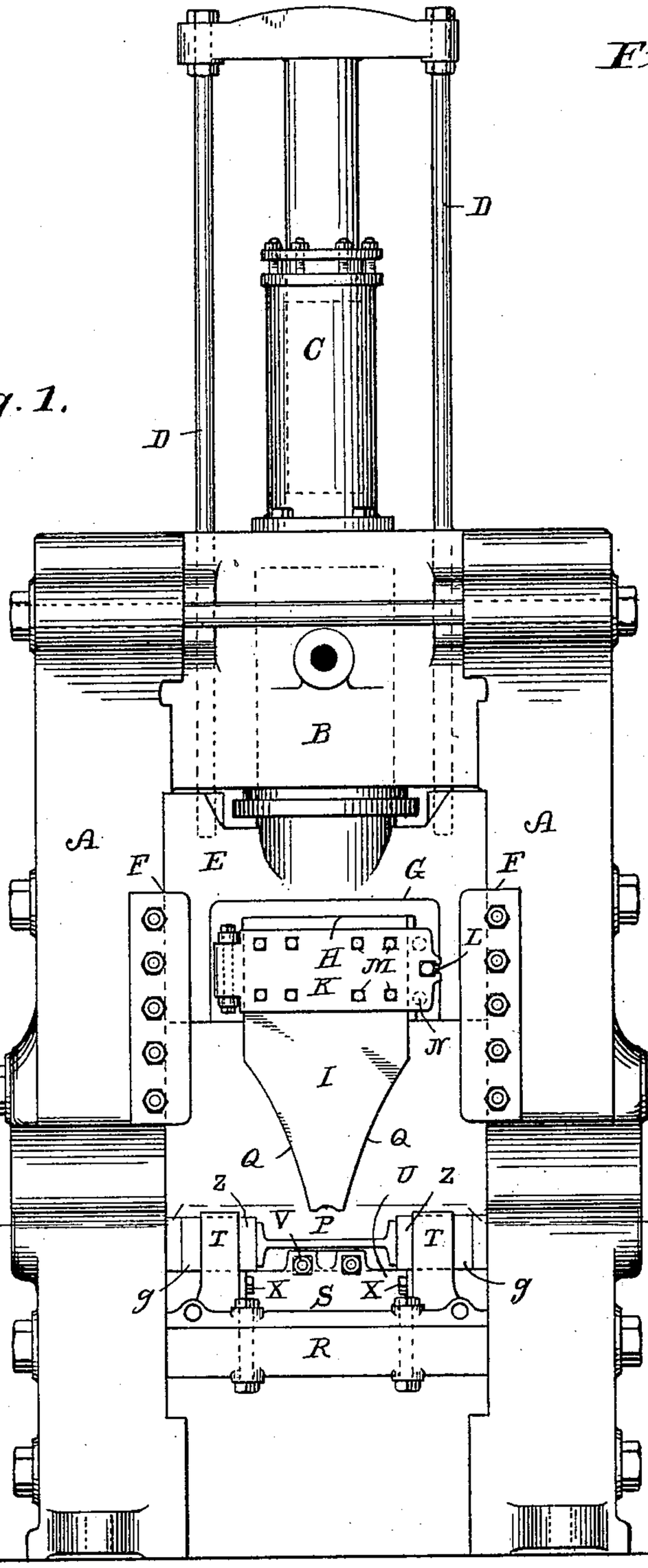


Fig. 7.

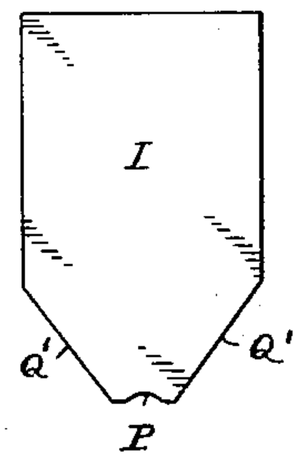
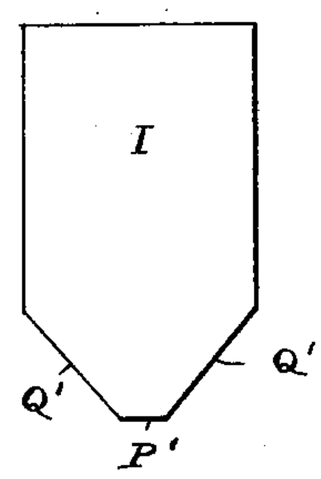


Fig. 7a



WITNESSES,

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N. L. Doyle

INVENTOR.

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(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

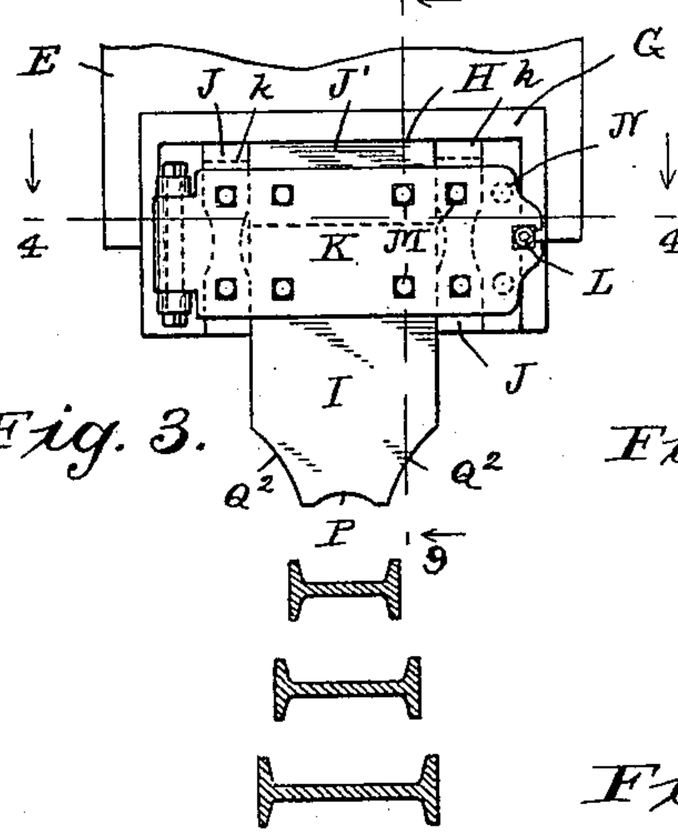


Fig. 6.

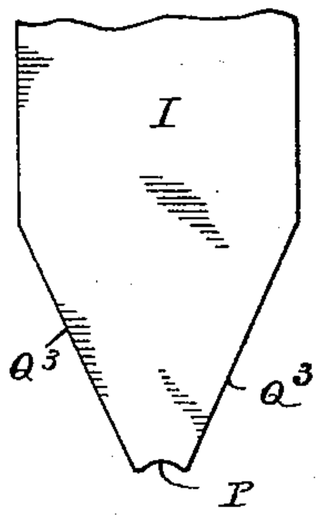


Fig. 9.

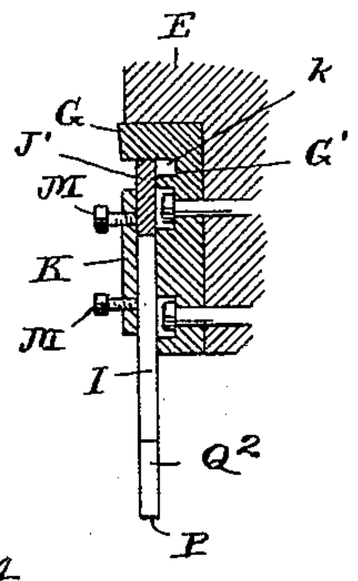


Fig. 4.

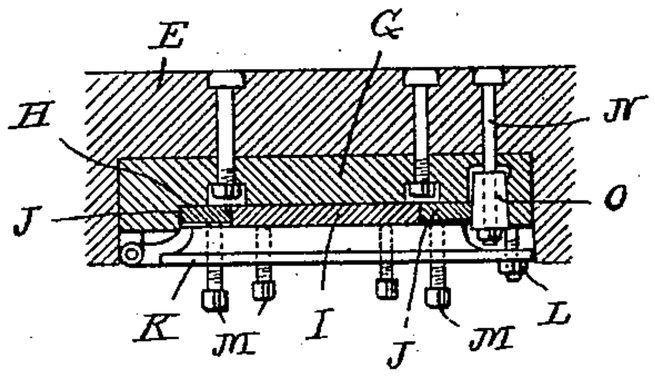


Fig. 2.

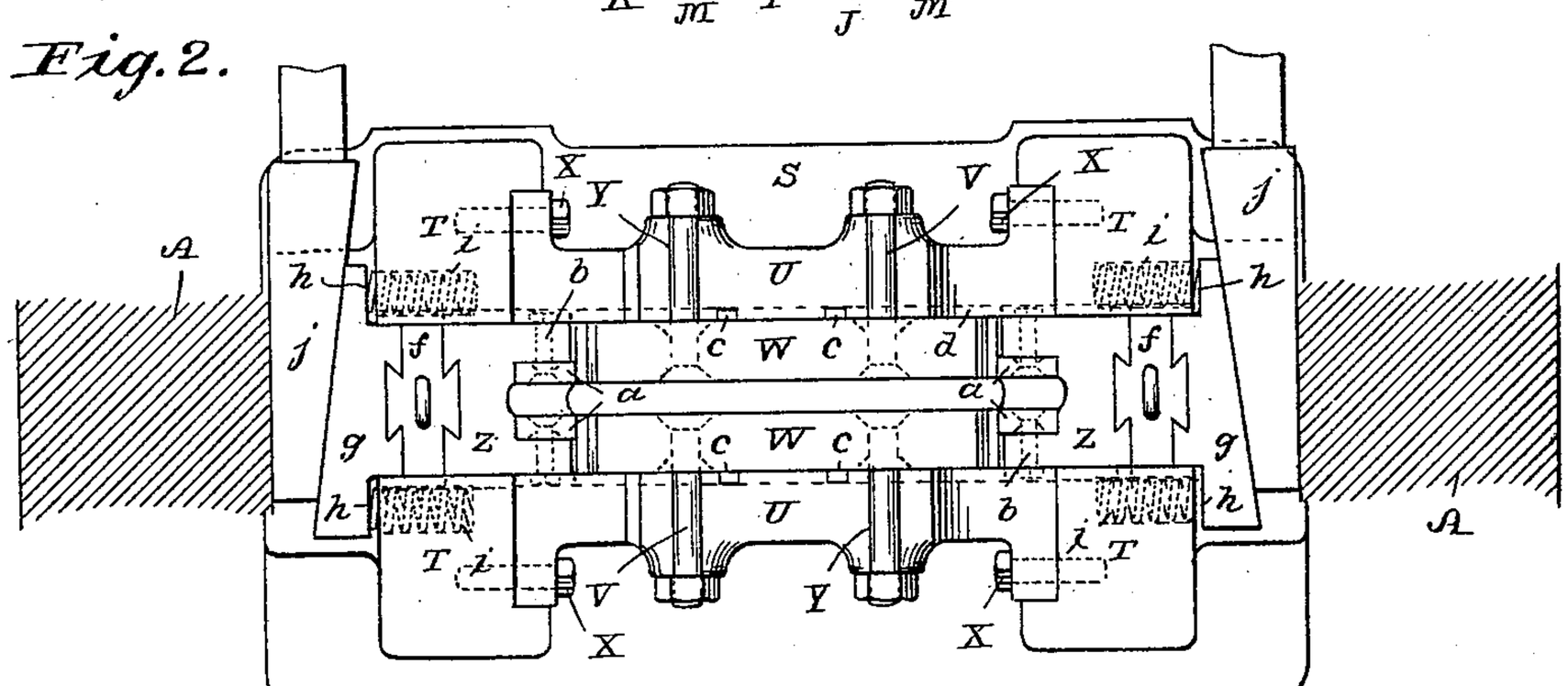


Fig. 8.

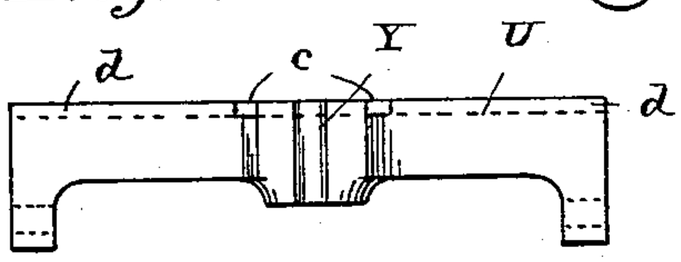


Fig. 5.

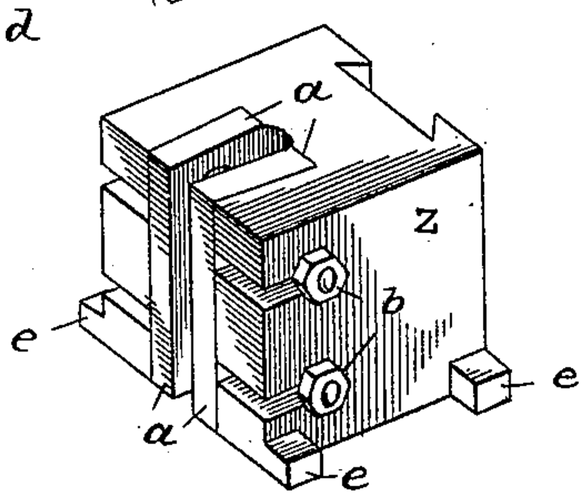
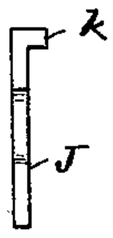


Fig. 10.



WITNESSES,

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GEORGE E. THACKRAY, OF WESTMONT, PENNSYLVANIA.

METAL-SHEARING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 631,832, dated August 29, 1899.

Application filed May 9, 1899. Serial No. 716,102. (No model.)

To all whom it may concern:

Be it known that I, GEORGE E. THACKRAY, a citizen of the United States, residing in the borough of Westmont, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Metal-Shearing Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Heretofore in the art and practice of shearing metals and particularly rolled sections of structural material—such as I-beams, channels, &c.—it has been customary to use a shear or similar tool provided with top knives and bottom knives, both of which fit or conform to the section to be cut quite closely, and in cutting certain forms of bars, such as I-beams and channels, these tools have also been provided with side knives in cases where the form of section was such that these were considered necessary.

Although my improvements in metal-shearing apparatus are applicable to a great range of shapes, I will, in order to simplify the description and the drawings, confine myself more particularly to the illustration and explanation of my improved apparatus for cutting I-beams and the method of performing this operation.

One accepted form of beam-shear which has previously been used consists, essentially, of an upper knife which is so formed that it fits closely against the web and between the flanges of the beam, which latter rests meanwhile upon two bottom knives spaced at a distance apart about equal to the thickness of the top knife, and said bottom knives are also fitted closely to the section of the beam. In addition to these top and bottom knives four side knives have also been used, which are adapted to be brought into close contact with the exterior of the beam-flanges and forcibly held thereto to withstand the pressure due to the shearing action which is accomplished by forcing the top knife through the beam, thus punching out pieces of metal from the beam web and flanges, which pieces are practically of the same thickness as the top knife. In tools of this class it has been necessary to have a special set of knives for each and every section which it was necessary to cut, and on this account the use of said tools is limited for the reason that they cannot be quickly changed to cut first one size and then another, as becomes necessary in filling an order for this character of material. With a knowledge of these disadvantages I have devised a novel apparatus for cutting I-beams, channels, &c., which consists, essentially, of a top knife which is comparatively narrow at the point, so as to cut the smaller sizes, and is as wide in its upper portions as may be necessary to pass through the largest section desired to be cut by said knife, and said knife is further provided with sloping cutting edges extending from the narrow lower portion to the wider upper portion in such a way that in forcing it through a beam the web portion of said beam is first neatly sheared, after which the sloping sides of the knife in their downward motion sever the beam-flanges.

My improved tapered form of upper knife may be used in connection with any suitable form of bottom and side knives; but in order to take full advantage of the universal adaptation of my improved top knife I also provide bottom knives and side knives which are quickly and easily adjusted so as to cut the various sizes.

Although I have illustrated my improved top knife in connection with two bottom knives, between which it operates to shear or punch a piece out of the section to be cut, I do not limit myself to this combination, as it may also be used in connection with a single bottom knife, thus cutting a bar in two without removing a section of the same, thus acting in single shear, as may be readily understood.

My improved forms of knives may be used in any design of shear provided with means for forcing the top knife through the section to be cut; but in the illustrations of my invention I have shown them in connection with a shear operated by hydraulic or fluid pressure.

In addition to the improved form and arrangement of top knife, bottom knife, and side knives which I have referred to I also have made improvements in the apparatus for securing and adjusting the knives in po-

sition in the machine, whereby this may be more quickly and readily done, as will hereinafter more fully appear.

Having thus given a general description of my invention, I will now describe it more particularly in connection with the two sheets of drawings annexed hereto, which form part of this specification, and in which like letters of reference indicate like parts.

Figure 1 is a front elevation of a shearing-machine fitted with my improvements. Fig. 2 is a small enlarged sectional plan view taken on the line 2 2 of Fig. 1 and shows my arrangement of lower knives, side knives, and means for changing and adjusting the same. Fig. 3 is a detail front view of a part of the sliding cross-head of the machine, showing my improved apparatus for securing and adjusting the upper knife therein, and in this view is shown a small-sized blade of my improved construction adapted for a certain range of work, as indicated by the three beam-sections below the knife. Fig. 4 is a horizontal cross-section, taken on the line 4 4 of Fig. 3, through the sliding cross-head, the knife-holder, and the top knife, showing the apparatus for securing and adjusting the top knife within the sliding cross-head. Fig. 5 is an enlarged detail perspective view of one of the adjustable blocks for holding the side knives. Fig. 6 shows another form of my improved top knife, adapted for cutting a larger range of sizes of beams than that illustrated in Fig. 3, as indicated by the sectional diagrams below the knife. Fig. 7 is another modified form of my improved top knife, in which the angle of the sloping sides with the longitudinal axis is somewhat greater than shown in Fig. 6. Fig. 7ª is another modified form of top knife, which is similar to that shown in Fig. 7, with the exception that the lower edge is straight, as indicated by P′. Fig. 8 is a plan view of a lower-blade holder having a smaller projection than that shown in Fig. 2 and is adapted for holding a smaller size of bottom knife by means of one bolt only. Fig. 9 is a vertical cross-section on the line 9 9 of Fig. 3, showing cross-head, blade-holder, gate, top knife, and top liner for same in cross-section and the side liners in partial elevation. Fig. 10 is a separate view of a side liner provided with a projection for temporarily securing it in place within the recess of the blade-holder.

Referring now to the various characters of reference marked upon the drawings, A is the main frame of a metal-shearing machine; B, the operating-cylinder; C, the return or drawback cylinder, and D are drawback-rods secured to the plunger of the return-cylinder C and the cross-head E, whereby the latter is withdrawn after an operative stroke by the action of fluid-pressure in said cylinder C. The operating-cylinder B is connected with any suitable source of fluid-pressure supply, which may be controlled by valves conveniently located within reach of the operator, while the return or drawback cylinder C, which is of smaller diameter, is ordinarily constantly connected with a source of fluid-pressure supply, so that when the pressure is withdrawn from the larger operating-cylinder B after the completion of a stroke the cross-head E is automatically returned to its upper position by the action of the return-cylinder C and its connections.

F are ways or side guides secured to the frame A for supporting and directing the sliding cross-head E.

G is the upper-knife holder secured in a suitable recess formed within the cross-head E, while H is a recess in said blade-holder G, in which is secured the top knife I. As shown in Fig. 1, the top knife I entirely fills the recess H in the blade-holder G with the exception of a small space at the right-hand side, which is provided for the wedge O, (shown in Fig. 4,) whereby the knife may be securely clamped laterally by means of said wedge O and its bolt N. As shown in Figs. 3 and 4, however, in which a narrower knife is used, I provide side liners J for filling up the space within said recess H, so that the wedge O can laterally clamp the knife and liners securely within the recess of the blade-holder, so as to hold said knife rigidly in said direction. I prefer to make said side liners with a projection at their upper ends to fit in a groove formed in the blade-holder G, so as to hold them in position until the gate is shut and they are finally secured by means of the wedge O and the set-screws M.

As a ready means of clamping the knife in a direction at right angles to its principal surface I provide a gate K, which is hinged to the blade-holder G, as shown in Figs. 1, 3, and 4, said gate being provided with a single bolt L for locking it shut, thus making it a very simple matter to secure it in position. The bolt L may be provided with a swivel connection to the blade-holder G, so that it may be readily swung into or out of its locking position, thus requiring only a small movement of the nut on said bolt to open or close said gate. This operation is further facilitated by making the bolt-opening in the gate K of **U** form, open at its outer edge, as shown. Said gate K is further provided with a number of set-screws M, and in the operation of securing a knife within the holder said screws may be forced against the blade I or the side liners J after the gate is locked by means of the bolt L, said gate, bolts, and set-screws therefore serving to secure the blade firmly in all directions within its holder.

As shown in Figs. 9 and 10, J is a side liner for the top blade I, provided with a projection *k* to fit in the groove G′ of the blade-holder for the purpose of temporarily holding it in position previous to finally securing it by means of the gate K and the set-screws M.

In operation the main upward thrust of the knife I is taken up against the upper surface of the recess H in the knife-holder, and the

gate, set-screws, wedge, &c., serve to support the knife in proper position during the operative stroke and to hold it sufficiently secure to enable it to be withdrawn after the cut is accomplished.

Although the upper edge of the top knife may bear directly against the surface H of the blade-holder G, as shown in Fig. 1, I also provide top liners J', made in a series of various depths, to be inserted between the upper edge of the top knife and the surface H of the blade-holder G, as shown in Fig. 9, and by this means I can continue to adjust and use a top knife after it has been dressed and made shorter by reason of wear to its cutting edges. The gate K serves as a ready means for securing said top liner in position, and it may be securely clamped in a direction at right angles to its principal surface by some of the set-screws M. As the top knife becomes shorter and shorter, due to successive dressings, I use top liners which are of greater depth, thus adjusting the cutting edges to their normal position, and this can be continued until the knife becomes so short that there is not enough material remaining to allow it to be secured within the gate. As the top knives are expensive, this arrangement, which provides for economy in adjustment and use, is of great advantage.

From the foregoing it will be seen that the upper knife I can be quickly changed, adjusted, and firmly secured in place in a practical and efficient manner, and all that is necessary to accompiish this is to place the knife in position, draw up the bolts of the wedge O slightly, shut and lock the gate by means of the single bolt L, and then slightly tighten the set-screws N, all of which can be done in a minute's time, if necessary.

Referring now to the special shapes of top knives which form a novel and particular part of my invention, the knife shown in Fig. 1 is provided with a long curved taper at its sides (marked Q) and a central concave recess in its lower edge, (marked P.) This form of knife may be used in a machine which has a stroke sufficiently long, and the lower portion of its tapered end can be used for cutting the smaller sizes, while for cutting the larger sizes more and more of the tapered portion can be forced downward until the largest size can be cut, and this is limited only by the width of the knife. A similar form of knife is shown in Fig. 6, in which, however, the side slopes Q^3 are made straight instead of curved. Another form of top knife is shown in Fig. 7, in which the side slopes Q' are at a greater angle with the vertical, and a knife formed thus in some cases may have a better action in cutting the web than one with a lesser angle or longer taper. By reason of the angle shown in Fig. 7 the shearing action between the side slopes Q' and the lower knives W is more pronounced. In cutting beams, however, in which both the web and the flanges are to be cut by side slopes of one knife care must be taken to so proportion said side slopes that they act equally well upon the web and the flange, and the necessity for this will be seen when it is understood that the web and flanges of a beam are practically at right angles to each other, and a knife moving in one direction must have its side slopes so proportioned as to act equally well upon both. If the angle of the side slopes with the vertical is too small, the web will be torn or buckled, while the flange would be neatly cut, and, on the other hand, if the side slopes of the knife form too great an angle with the vertical the web would be neatly cut, but the flanges would be likely to be crushed thereby.

While the form of knife shown in Fig. 7^a is similar to that shown in Fig. 7, it has this modification, its lower edge P' is straight, and although the lower edge in most of the knives illustrated is herein shown with a concave curve I consider this to a certain extent an immaterial point, as this portion may be any form, and, in fact, I could use a knife the side slopes of which meet practically in a point, thus making the lower edge to be a mere line or point.

The form of knife illustrated in Fig. 3 has curved side slopes Q^2, which are comparatively short, and this form of knife is particularly adapted to machines having a short stroke, although, as indicated in this drawing, this to a certain extent limits the range of sizes which can be cut thereby.

Although my improved universal top knife may be so proportioned and constructed as to cut the entire commercial range of sizes of I-beams, channels, and other sections, I do not limit myself to one such knife for all sizes, but may make them in a series, each one of which is adapted to cut a certain number of sizes, as indicated diagrammatically in Figs. 3 and 6, as herein explained in the description of said figures and elsewhere. This construction of the top knives in a series each of which is adapted to cut a certain number of sizes gives an arrangement whereby the stroke of the machine is shortened and the number of cuts made in a given time correspondingly increased.

The lower knives, which operate in connection with the movable upper knife, are mounted in a base S, which is secured on the bed R of the machine, and said bed S contains four posts or guides T. The front and rear pairs of guides are each connected by a vertical flange or bottom-blade holder U, which may be formed integral with the base S, or it may preferably be separate and detachably secured thereto by means of the bolts X, as shown in Fig. 2. If the bottom-blade holder U is made separate and detachable, as shown in Figs. 2 and 8, the upper and projecting portion of said bottom-blade holder can be well arranged to hold and support different sizes of bottom knives W, and I therefore prefer my improved form, as in this construc-

tion said blade-holder U can be readily changed or replaced, if necessary, to suit any size of bottom knife W, and the upper portion of said blade-holders may be made of different sizes, so as to thoroughly and properly support said bottom knife as may be necessary. The blade-holder U is provided with slotted holes Y, which are adapted to hold the bolts V, which are provided with a countersunk head and nut, as shown, for securing the bottom knives W to said blade-holder.

As shown in Figs. 1, 2, and 5, Z are adjustable side blocks which contain the side knives *a*, secured therein by means of the bolts *b*. Within the flange or bottom-blade holder U, I form vertical grooves *c*, which intersect similar longitudinal grooves in the base thereof and in the side posts T, which grooves serve as means to receive and retain the lugs *e* upon the side block Z, thereby holding said block in position. The blade-holder U and posts T are also provided with longitudinal recesses which contain the head of the bolts *b*.

As a means of adjusting and securing the side knives *a*, which are secured within the block Z, I provide dovetailed liners *f*, which serve to unite said block Z and the inclined blocks *g*, as shown in Fig. 2. I provide a series of these intervening dovetailed blocks, of such thickness that when the proper one is introduced the side knives *a* will be at the proper distance apart to cut any size beam that may be desired. When arranged for cutting the largest size beam, the blocks *g* rest directly against the blocks Z, which are held together for the return movement by small dovetailed pieces similar to the block *f*, (shown in Fig. 2,) but of such thickness that the adjoining surfaces of the blocks *g* and blocks Z are in contact. The inclined blocks *g* are provided with shoulders *h*, against which the springs *i* operate to free the side knives *a* from the bottom knives W when the side pressure from the wedges *j* is released.

The pressure for forcing the side knives against the beam-flanges is accomplished by means of the wedges *j*, which are forced in between the inclined blocks *g* and the sides of the frame of the machine, and said wedges *j* may be operated by any suitable means, such as hydraulic or air pressure cylinders; or, in fact, the side knives *a* may be forced against the beam-flanges directly by means of direct-acting cylinders, a screw, or other means without the use of said wedges, if considered necessary or expedient.

In operating my improved metal-shearing apparatus to cut any size of beam, for example, the proper sizes of bottom knives are set in place and liners *f*, of suitable thickness, corresponding to the size of the beam, are introduced. A beam is then put upon the bottom knives in proper location, the side knives are clamped against the beam-flanges by means of the wedges *j*, acting against the inclined blocks *g*, which in turn transmit the pressure to the side knives *a* through the liners *f* (where such are used) and the blocks Z. After this is done the top knife I is brought down and cuts first the web and then the flanges of the beam. The top knife I will cut any size of beam between the flanges of which its lower edge can be inserted, and if the beam is of large size a piece will first be cut from the center of the web, after which the remainder of the web will be cut by the sloping cutting edges of the knife, and finally the flanges will be cut by said sloping cutting edges.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a metal-shear fitted with bottom knives and side knives, a universal top knife provided with a narrow point or lower cutting edge, of width such as to enter the smallest section to be cut by said knife, an upper portion the width of which is slightly greater than that of the largest section to be cut by said knife, continuously-inclined cutting edges connecting said upper and lower portions, and means for operating said knife.

2. In a metal-shear, a series of removable bottom knives, one or more adjustable side knives, a universal top knife provided with a narrow point or lower cutting edge, of width such as to enter the smallest section to be cut by said knife, an upper portion the width of which is slightly greater than that of the largest section to be cut by said knife, continuously-inclined cutting edges connecting said lower and upper portions, and means for operating the same.

3. In a metal-shear, the combination of a series of removable bottom knives, one or more side knives provided with means for adjusting and holding them in operative connection with any set of the series of bottom knives, a universal top knife and means for operating the same.

4. In a metal-shear, a series of removable bottom knives of various sizes, one or more pairs of side knives, side wedges or their equivalents for forcing and holding said side knives in operative position, a series of blocks adapted to be interposed between said wedges and said side knives whereby the latter are adjusted to coact with the bottom knives of different sizes, a top knife and means for operating the same.

5. A universal shearing-knife provided with a narrow lower cutting edge or point, of width such as to enter the smallest section to be cut by said knife, an upper portion the width of which is slightly greater than that of the largest section to be cut by said knife, continuously-inclined cutting edges connecting said lower and upper portions, said knife being thus adapted to cut a number of sizes of I-beams, channels or other sections.

6. In a metal-shear, a universal top knife provided with a narrow lower cutting edge or point adapted to enter the smallest section to be cut, an upper portion the width of which

is slightly greater than that of the largest section to be cut, continuously-sloping cutting edges connecting said lower and upper portions, a series of removable bottom knives of various sizes, one or more adjustable side knives, and means for operating said knives.

7. In a metal-shear, a series of removable bottom knives of various sizes, one or more pairs of side knives secured in an adjustable holder, wedges or other means for forcing and holding said side knives in operative position, a series of dovetailed blocks adapted to be interposed between said wedges and the adjustable side-knife holders, and springs for automatically removing said side-knife holders from their operative position.

8. In a metal-shearing machine, the combination with the reciprocating head, of a gate provided with a hinge, locking arrangement and set-screws for securing the shear-blade to said head.

9. In a metal-shearing machine, the combination with the reciprocating head, of a blade-holder secured thereto, having a recess therein, a gate provided with locking device and set-screws, a series of top and side liners, for adjusting and holding a shear-blade within said head.

10. In a metal-shearing machine, the combination with the reciprocating head, of a blade-holder secured thereto having a recess therein, a gate provided with a locking device and set-screws, a series of side liners, a wedge and means for operating the same for adjusting and holding a shear-blade within said head.

11. In a metal-shearing machine, a universal top knife provided with a narrow lower cutting edge or point, a wider upper portion, inclined cutting edges connecting said lower and upper portions, a series of removable bottom knives of various sizes, one or more pairs of side knives contained within an adjustable holder, wedges for forcing and holding said side knives in operative position, a series of dovetailed blocks adapted to be interposed between said wedges and the adjustable side-knife holders and means for operating the said knives.

In testimony whereof I hereto affix my signature in the presence of two witnesses.

GEORGE E. THACKRAY.

Witnesses:
H. L. BOYLE,
H. W. BARCLAY.