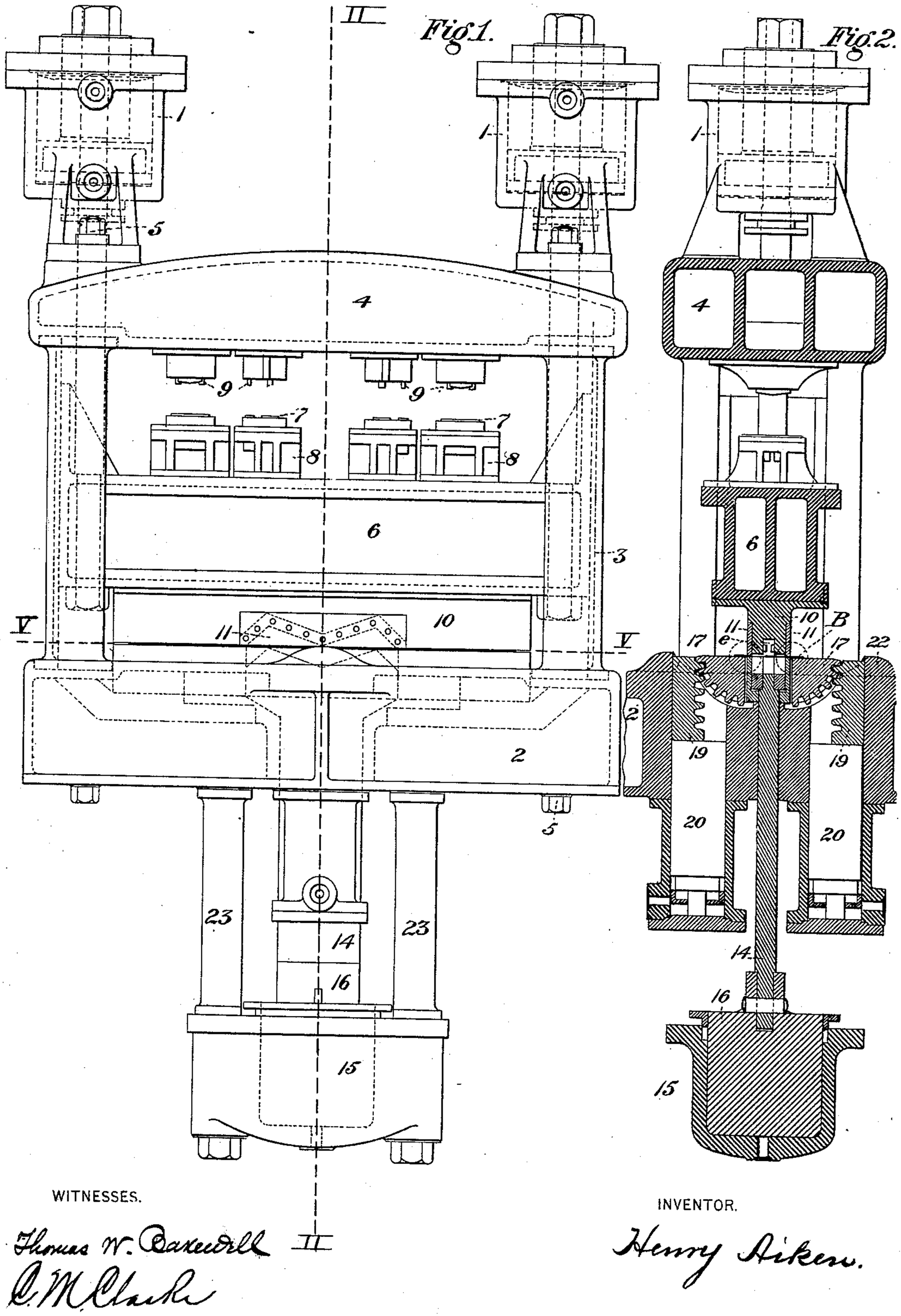
(No Model.)

6 Sheets—Sheet 1.

H. AIKEN.

MACHINE FOR SHAPING SHEET METAL.

No. 411,116. Patented Sept. 17. 1889.



WITNESSES.

Thomas W. Baxendell

C. M. Clark

INVENTOR.

Henry Aiken.

(No Model.) 6 Sheets—Sheet 2.

H. AIKEN.

MACHINE FOR SHAPING SHEET METAL.

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Fig. 4.

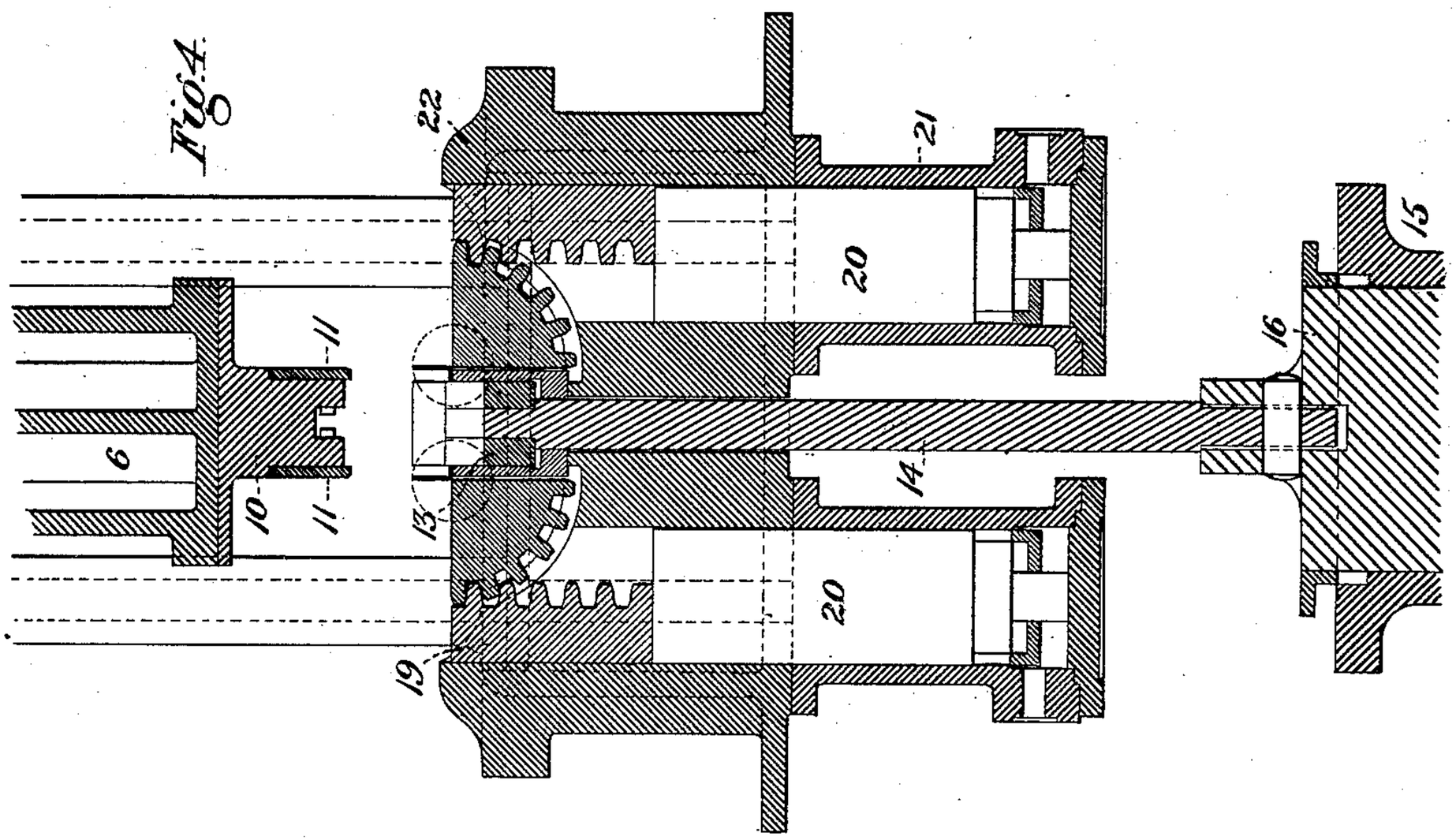
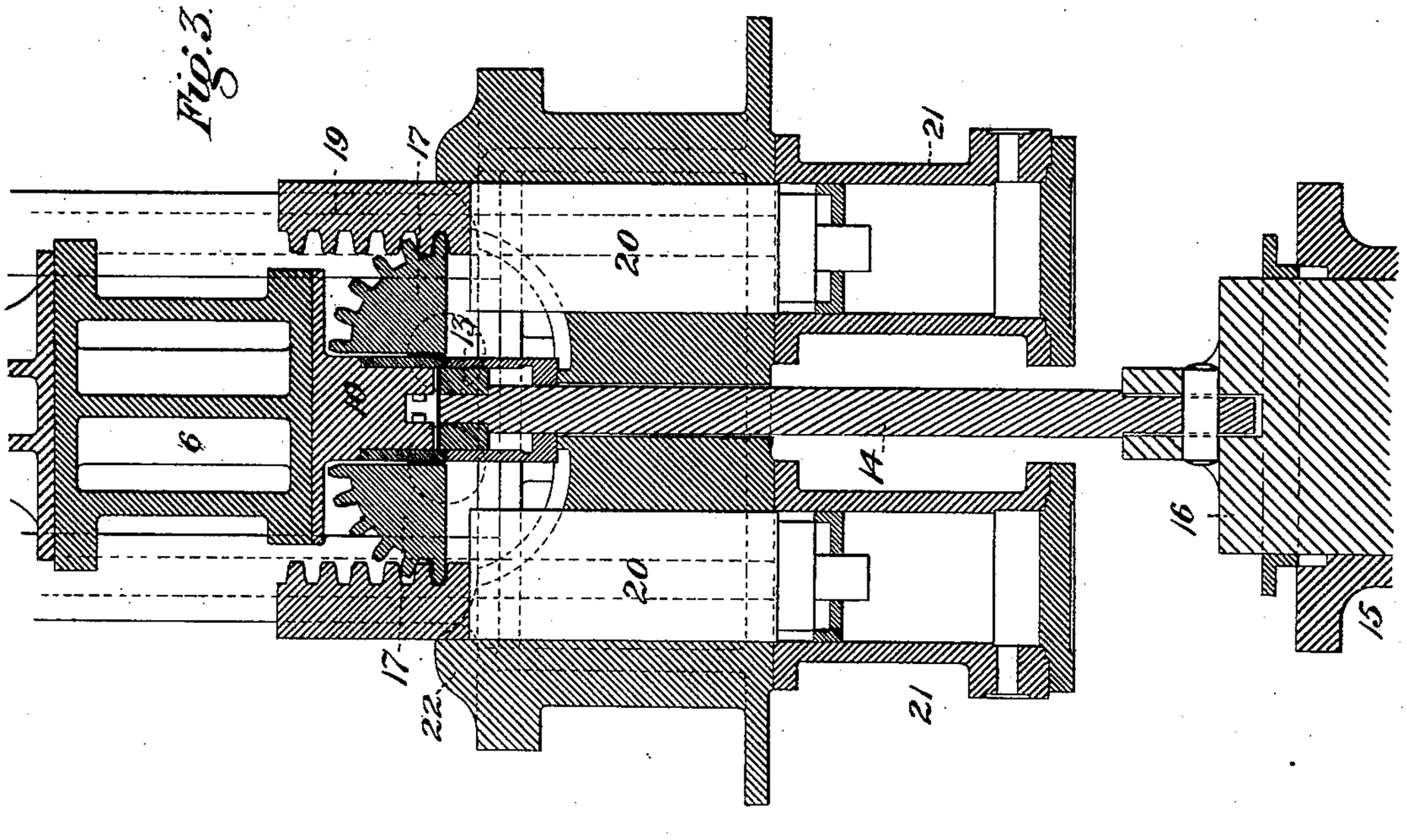


Fig. 3.



WITNESSES.

Thomas W. Bakewell

O. M. Clarke

INVENTOR.

Henry Aiken.

(No Model.) 6 Sheets—Sheet 3.

H. AIKEN.

MACHINE FOR SHAPING SHEET METAL.

No. 411,116. Patented Sept. 17, 1889.

Fig. 5.

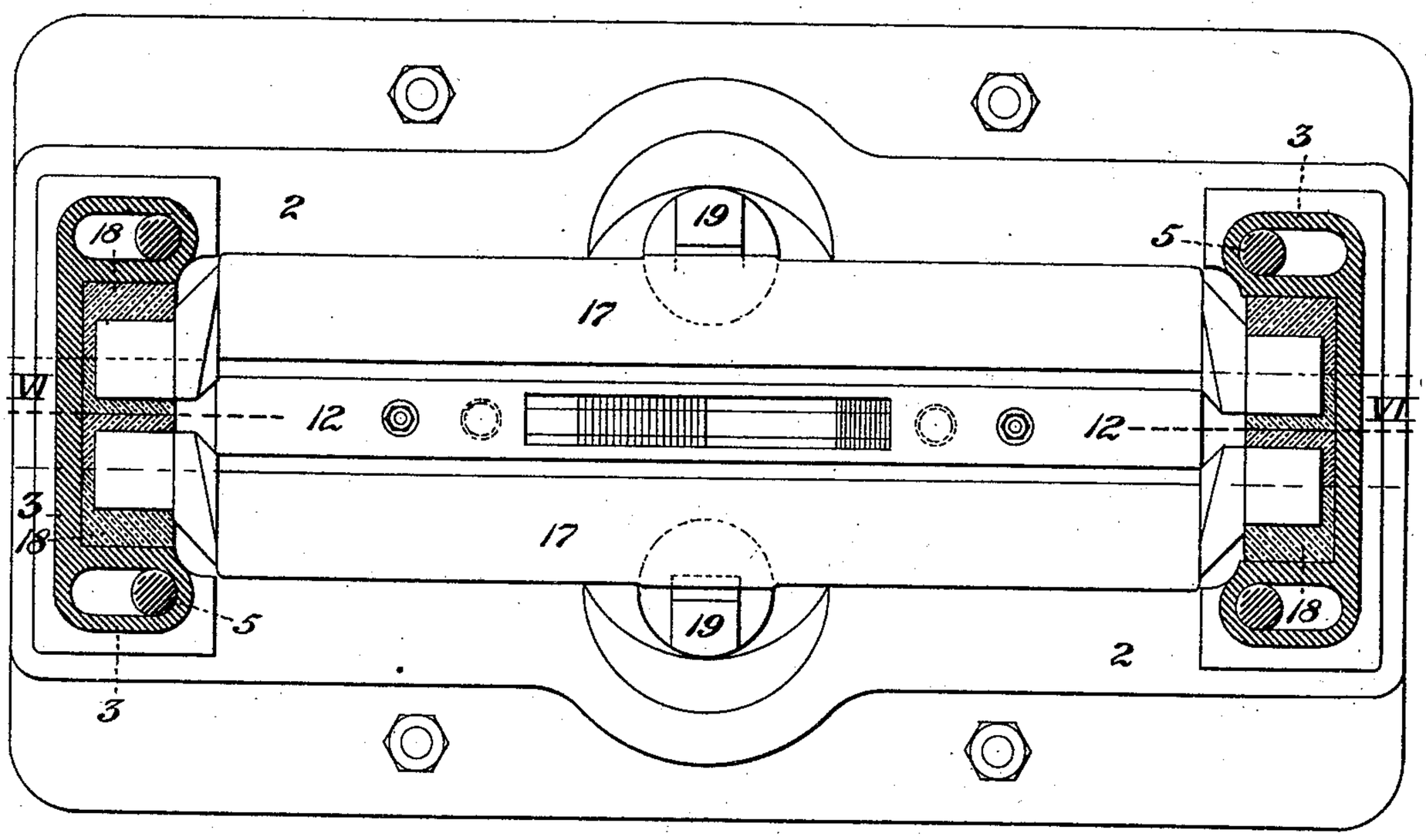
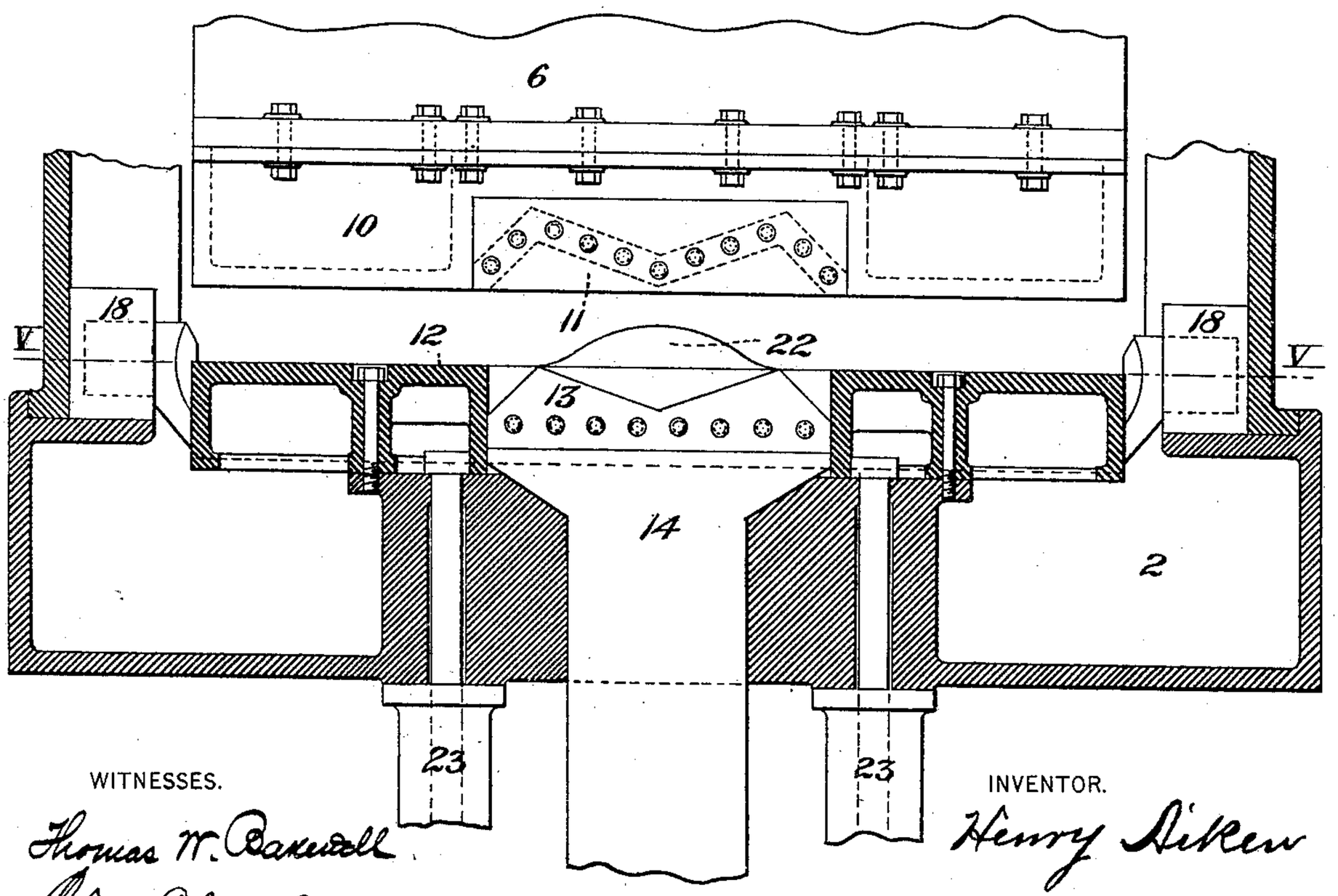


Fig. 6.



WITNESSES.

Thomas W. Bakewell

C. M. Clarke

INVENTOR.

Henry Aiken

(No Model.) 6 Sheets—Sheet 4.

H. AIKEN.

MACHINE FOR SHAPING SHEET METAL.

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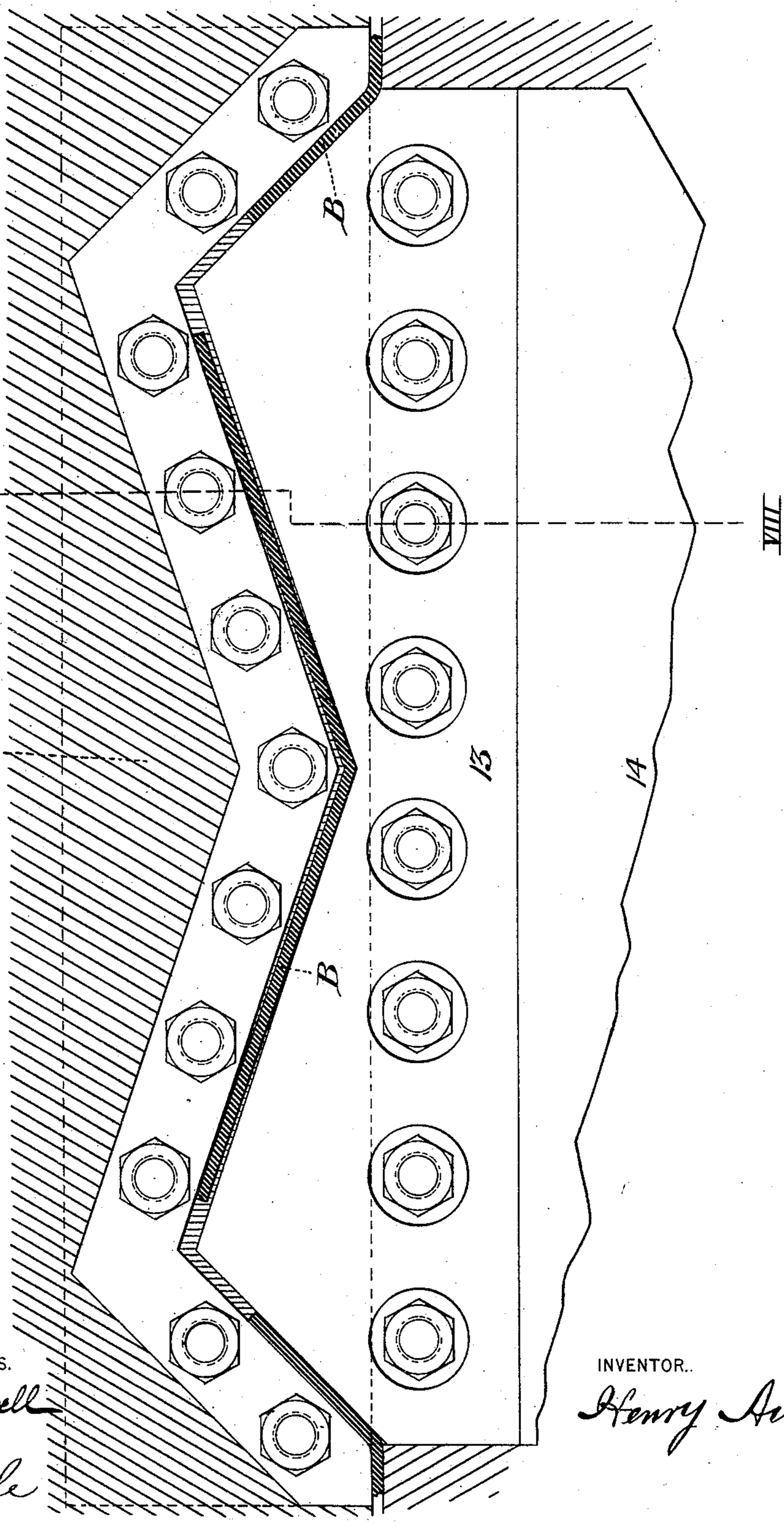

Fig. 2.

WITNESSES.

J. W. Bakewell

A. M. Clarke

INVENTOR.

Henry Aiken

(No Model.) 6 Sheets—Sheet 5.

H. AIKEN.

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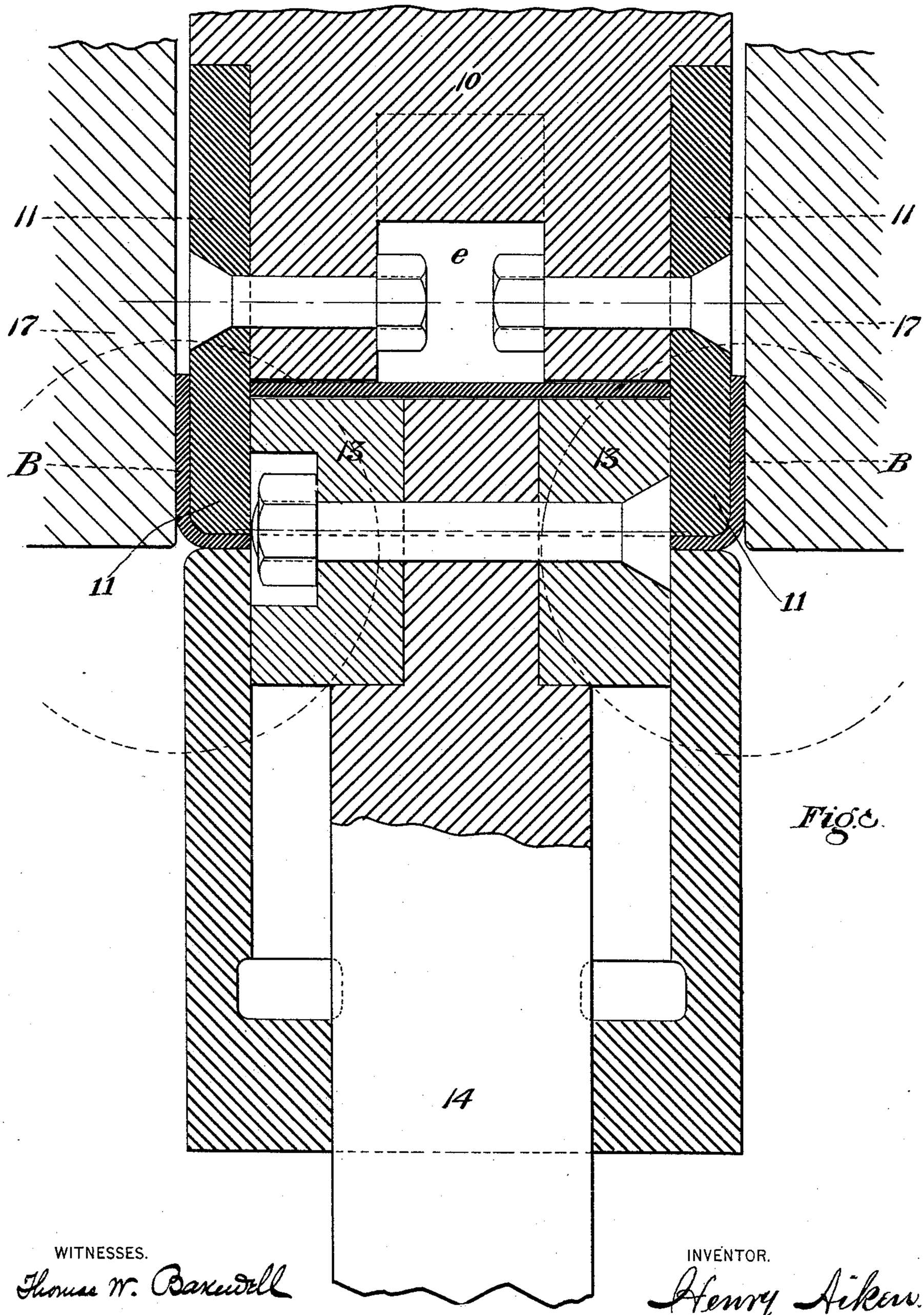

Fig. 6.

WITNESSES.

Thomas W. Bakewell

O. M. Claike

INVENTOR.

Henry Aiken.

(No Model.) 6 Sheets—Sheet 6.

H. AIKEN.

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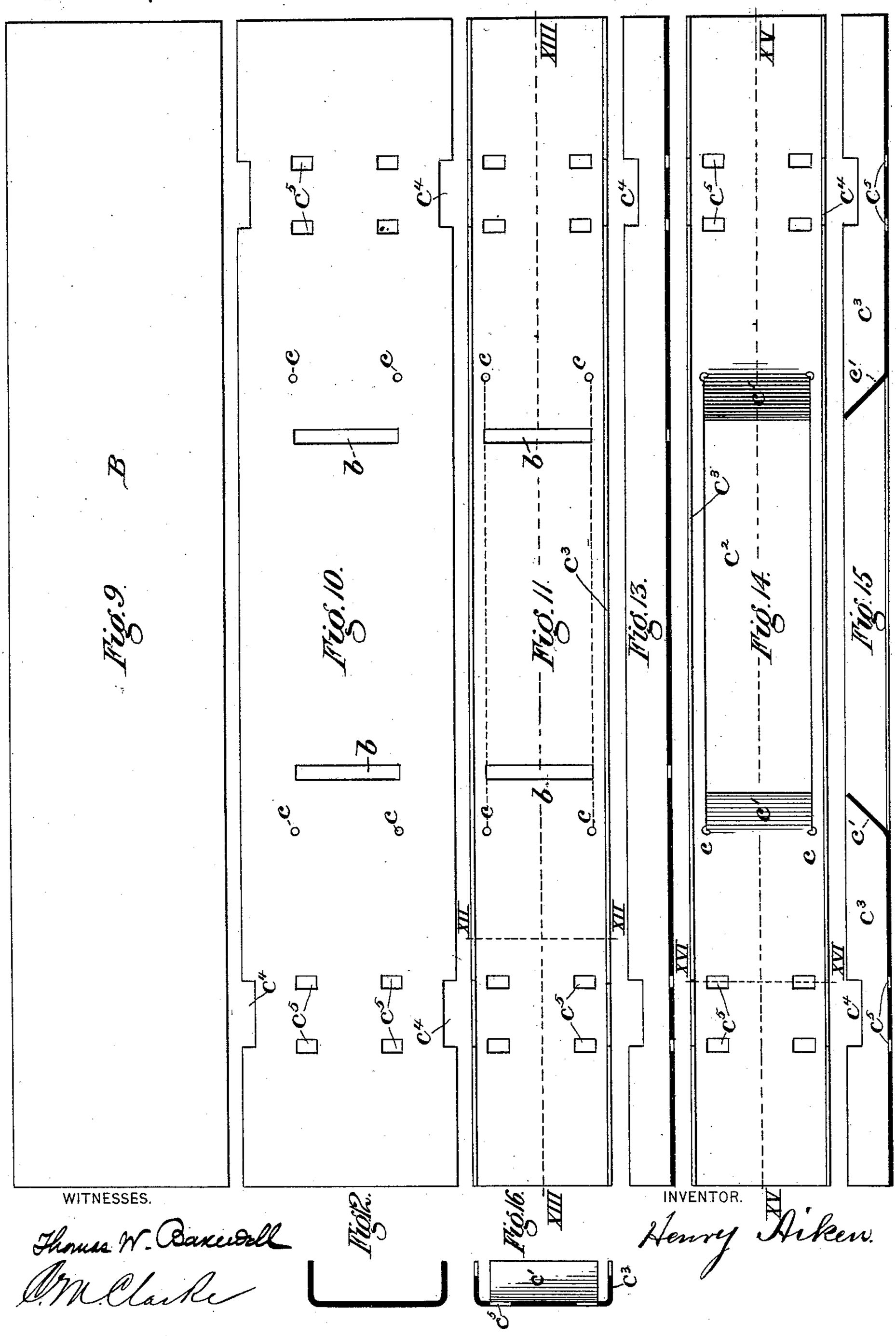

UNITED STATES PATENT OFFICE.

HENRY AIKEN, OF HOMESTEAD, PENNSYLVANIA.

MACHINE FOR SHAPING SHEET METAL.

SPECIFICATION forming part of Letters Patent No. 411,116, dated September 17, 1889.

Application filed May 11, 1889. Serial No. 310,426. (No model.)

To all whom it may concern:

Be it known that I, HENRY AIKEN, of Homestead, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Machines for Shaping Sheet Metal, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation of my improved machine. Fig. 2 is a vertical cross-section on the line II II of Fig. 1. Fig. 3 is an enlarged vertical section of the machine in the position which the parts occupy at the conclusion of the operation of bending the metal tie. Fig. 4 is a similar section showing the machine as it is when its work is completed and when its parts are restored to their normal position. Fig. 5 is a horizontal cross-section on the line V V of Figs. 1 and 6. Fig. 6 is a vertical longitudinal section taken as on the line VI VI of Fig. 5. Fig. 7 is an enlarged vertical longitudinal sectional view of the cutting and shaping die. Fig. 8 is a vertical cross-section on the line VIII VIII of Fig. 7. Fig. 9 is a plan view of a metal blank adapted to be formed by my improved machine into the shape of a railway-tie. Fig. 10 is a plan view illustrating the product of the first operation of the machine. Fig. 11 is a plan view illustrating the second operation of the machine. Fig. 12 is a vertical cross-section on the line XII XII of Fig. 11. Fig. 13 is a vertical longitudinal section on the line XIII XIII of Fig. 11. Fig. 14 is a plan view of the finished tie. Fig. 15 is a vertical longitudinal section on the line XV XV of Fig. 14, and Fig. 16 is a vertical cross-section on the line XVI XVI of Fig. 14.

Like symbols of reference indicate like parts.

My improved machine has been devised principally for the purpose of forming and shaping plate-metal railway-ties of the sort illustrated in Figs. 14, 15, and 16, and I shall so describe it, premising, however, that it is not limited thereto, but is claimed herein broadly and without restriction to its application to the manufacture of any particular article.

Referring to the drawings, 2 represents the bed-plate of the machine.

3 3 are upright frames constituting guides in which the head or plunger moves, and which for this purpose are made of strong metal castings, as shown in Figs. 1 and 5.

4 is a cap or entablature which connects the upright frames, and 5 are strong bolts or rods which hold the entablature to the bed-plate.

The moving head 6 is a strong cast frame set between the upright guides and connected by rods or bolts with the plungers of double-acting cylinders 1, mounted on the entablature and provided with inlet and outlet ports at opposite ends, so that the plungers can be moved in either direction by proper management of the valves. The moving head is on one side provided with a series of cutters or dies for cutting or slotting the metal blank, and on the other side is provided with shearing and bending mechanism for subsequently acting thereon. The cutters or dies 7 are mounted on stools or supports 8 on the upper side of the moving head, and their counterparts or companion dies or cutters 9 are fixed to the under side of the entablature.

In the operation of cutting the metal blank shown in Fig. 9 is interposed between the entablature and the moving head and is cut by the dies on the ascent of the latter, so as to produce therein cuts of the form shown in Fig. 10. On the under side of the moving head is bolted a knife-head 10, the base of which at the middle part is formed in the double-angled shape shown in Fig. 6, and on each side of this part of the knife-head is secured a square-edged knife or cutter 11, (shown in Figs. 1 and 2,) so that between the knives there is an intermediate cavity, the base of which is of the double-angled form above mentioned. The knife-head is also provided with a slot or cavity *e*, into which project the heads of the bolts by which the knife-blades are secured, so that the exterior faces of such blades shall be perfectly plain and shall afford no obstruction to the bending of the edges of the metal plate in the manner hereinafter described.

An anvil-plate or casting 12 is bolted to the bed-plate of the machine beneath the knife-head 10, the middle part of the anvil being slotted to permit ascent of the moving knife and bender, hereinafter to be described, and the remaining portion of the anvil being flat,

so that, in connection with the opposite part of the knife-head 10, it may be capable of holding tightly an interposed plate or blank. (See Fig. 1.) The lower knife 13 consists of blades fixed on shoulders at the end of a plunger or knife-head 14 and conjointly of proper cross-sectional area to enter the space between the knives 11. The edges of these blades are made of angled form corresponding to the angle of the base of the cavity of the upper knives, so that they shall have a shearing action on the metal and shall bend and shape it in the manner hereinafter described.

The knife-head 14 extends vertically through the bed-plate and at the lower end is keyed to the plunger 16 of a hydraulic cylinder 15, which, by means of bolts and separators 23, is secured to the bed of the machine.

For the purpose of forming marginal flanges on the metal plate or blank I employ bending devices consisting of metal bars 17, made in form of sectors of cylinders, having at their ends journals, which are set in suitable bearings 18 on the machine-frame. Normally these sectors occupy the position shown in Fig. 2, one side of each being flush with the level of the anvil-plate 12 and underlying a marginal portion of the metal plate or blank. They are operated to bend the plate by being turned axially on their journals by the following mechanism: At the middle of each of the bending-bars is formed a peripheral series of gear-teeth, and on each side of the machine is a rack-bar 19, whose teeth are in gear with the teeth on the bending-bar, and which are attached to or form part of the plungers 20, working within hydraulic cylinders 21, which are bolted to the bed of the machine. The rack-bars 19 move in cavities in the bed-plate and are backed and supported by strong re-enforcements or bosses 22, formed on the latter.

The manner of operation of the machine is as follows: The plate or blank B, (shown in Fig. 9,) having been interposed between the dies 7 and 9, is cut by the ascent of the moving head, and is brought thereby into the form shown in Fig. 10. It is then placed upon the anvil-plate 12, and is held firmly by depressing the knife-head 10 thereon, as shown in Fig. 1. While in this position the lateral margins of the plate are bent into upright positions by elevating the plungers 20, thereby turning the sectors on their axes and bringing them into the positions illustrated in Fig. 3. The plunger 16 of the cylinder 15 is then raised by admitting motive fluid within the latter, and the knife 13 is thus forced against the plate toward the cavity between the upper knives, and thereby by the edges of these knives a piece is sheared out from the middle of the plate between the transverse slots *b b*, Figs. 10 and 11, and the plate is slit outwardly from these slots to holes *c c*, and at the same time the flat faces of the lower knives bend up within said cavity the lips *c'*, formed by slitting the plate in the manner just described. The parts of the machine are then in the position shown in Fig. 3. To remove the metal tie, the bending-sectors are drawn back by exhausting the water from their motive cylinders, and the upper and lower knives are retracted, in one case by exhausting the water from the cylinder 15 and in the other case by reversing the action of the plungers of the cylinders 1. The ascent of the moving head 6 may be utilized for punching and slotting another blank or plate in the manner first above described, so that the motion of the plunger in both directions is made effective in the work of the machine.

By means of the machine constructed as above described I am enabled without distortion of the metal plate to bend and shape it into the form of a finished tie such as shown in Figs. 14 and 15, the work being performed with rapidity and efficiency, notwithstanding the high degree of power necessary to be employed. The bending of the marginal flanges before cutting out the piece from the middle of the blank, which is made possible by use of the machine, has an important effect on the product, because it prevents that distortion of the plate which would result from performing the bending subsequently to the cutting, and by use of the machine I am enabled to cut out the middle portion and to bend up the lips thereon at one operation, while to do the work at two or more operations would be troublesome and expensive.

The advantages of my improved apparatus will be appreciated by those familiar with the difficulties incident to the work of bending heavy pieces of plate or sheet metal. By employing a double-acting moving head 6 having cutting devices on one side and shearing and shaping devices on the other I am enabled with one machine to perform double work.

The construction of the bending devices (which I herein call "sectors," without, however, intending to limit myself thereby to any particular mathematical shape) and their operation by mechanism connected with the middle portions thereof and braced by the machine-frame are of advantage, because great strength and rigidity are thereby afforded to the parts and I am enabled to bend successfully heavy pieces of metal.

My invention consists in the several features of construction and arrangement just specified, in addition to other items which are set forth clearly in the following claims.

I do not claim herein specifically the method of making metal ties hereinbefore described, since I have made the same the subject of a separate application for Letters Patent filed May 29, 1889, Serial No. 312,643; but

I claim herein as my invention—

1. In a machine for shaping metal plates or sheets, a reciprocating plunger having on one side cutting-dies and on the opposite side bending and shaping dies, substantially as described.

2. The combination of the bed-plate, the entablature, and the head which reciprocates between the same, said head having on one side cutting-dies and on the opposite side bending and shaping dies, substantially as described.

3. The combination, with the knife-head and bed-plate or anvil adapted to clamp between them a metal sheet, of a knife for shearing or cutting the sheet when so confined, substantially as described.

4. In a machine for forming metal ties, the combination of knives arranged and adapted to cut in a metal plate slots *b* and a cutting and bending tool adapted to cut slits extending between and beyond the slots, thereby cutting out a piece of the metal, and to bend up lips *c'* on the outer side of the slots, substantially as described.

5. The combination of the knife-head 10 and the bed-plate or anvil adapted to hold an interposed metal sheet, with a knife which moves through said bed-plate and cuts the sheet in conjunction with the knife-head 10, substantially as described.

6. The combination, with the knife-head 10, of straight-edged blades 11, secured thereto, said knife-head having an intermediate cavity, and a moving knife adapted to enter said cavity and in conjunction with the blades 11 to shear and shape an interposed metal sheet, substantially as described.

7. The combination, with the knife-head 10, of straight-edged blades 11, secured thereto, said knife-head having an intermediate cavity, and a moving knife adapted to enter said cavity and in conjunction with the blades 11 to shear and shape an interposed metal sheet, the face of said moving knife being shaped to conform to the base of said cavity, substantially as described.

8. The combination, with the knife-head 10, of straight-edged blades 11, secured thereto, said knife-head having an intermediate double-angled cavity, and a moving knife adapted to enter said cavity and in conjunction with the blades 11 to shear and shape an interposed metal sheet, substantially as described.

9. The knife-head 10, having opposite knife-blades 11 and an intermediate slot *e*, for containing the heads of bolts which secure said knife-blades in position, substantially as described.

10. The combination, with clamping mechanism for holding an interposed metal sheet, of lateral bending-sectors and racks for operating the same, substantially as described.

11. The combination, with clamping mechanism for holding an interposed metal sheet, of lateral bending-sectors and racks for operating the same, said racks being situated at the middle portions of the sectors, substantially as described.

12. The combination, with clamping mechanism for holding an interposed metal sheet, of lateral bending-sectors and racks for operating the same, and a hydraulic cylinder whose plungers are connected with the racks, substantially as described.

13. The combination, with clamping mechanism for holding an interposed metal sheet, of lateral bending-sectors and racks for operating the same, and the machine bed-plate or frame which backs and braces said racks and takes up the thrust thereof, substantially as described.

14. The combination, with the knife-head and bed-plate or anvil adapted to clamp between them a metal sheet, of a knife for shearing or cutting the sheet when so confined and a hydraulic motor whose plunger operates said knife-head, substantially as described.

15. The combination of the bed-plate or anvil, the moving head adapted to clamp a metal sheet thereon, bending-sectors journaled at the sides of the bed-plate and adapted to bend the projecting edges of the metal sheet, mechanism for operating said sectors, and a moving knife which works through the bed-plate and engages the metal sheet, substantially as described.

16. The moving knife 13, in combination with its knife-head 14, the machine-frame having a passage or opening for the movement of the knife-head, and a bed-plate or anvil consisting of a metal casting fixed to the bed-plate and having a slot or opening for the passage of the knife, substantially as described.

17. The knife-head 14, having lateral shoulders at the end and knife-blades 13 set on said shoulders, substantially as described.

18. The combination of the machine-frame, the bending-sectors, hydraulic cylinders secured to the under side of machine-frame and having plungers connected with and operating said sectors, and a moving knife, and a hydraulic motor whose plunger is connected with and operates the same, substantially as described.

In testimony whereof I have hereunto set my hand this 4th day of May, A. D. 1889.

HENRY AIKEN.

Witnesses:

W. B. CORWIN,

THOMAS W. BAKEWELL.