Sept. 9, 1930. G. P. THOMAS 1,775,359

METAL PERFORATING MACHINE

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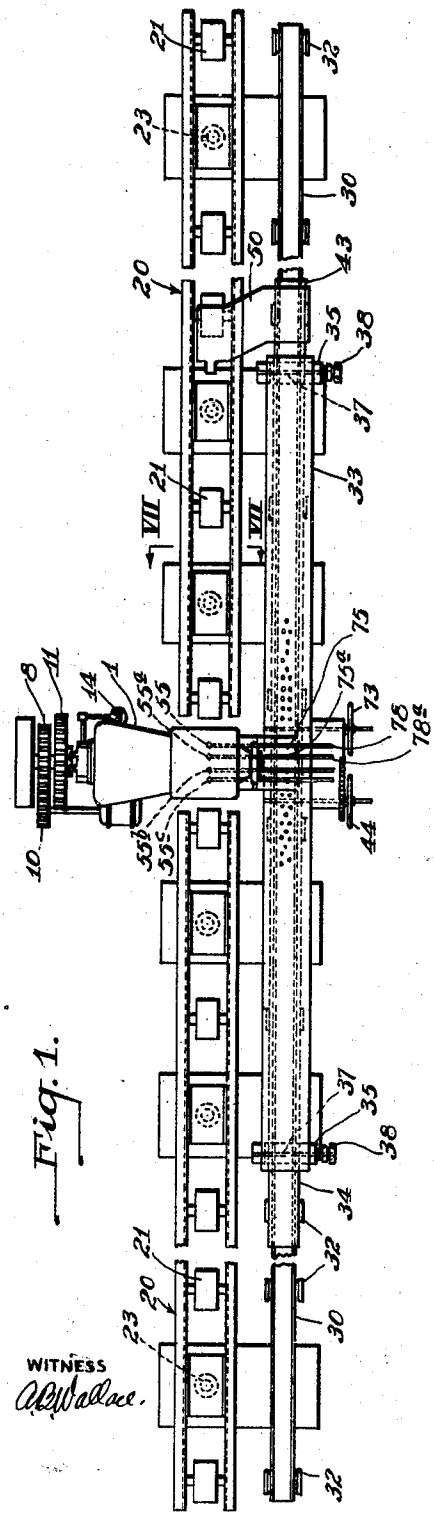


Fig. 1.

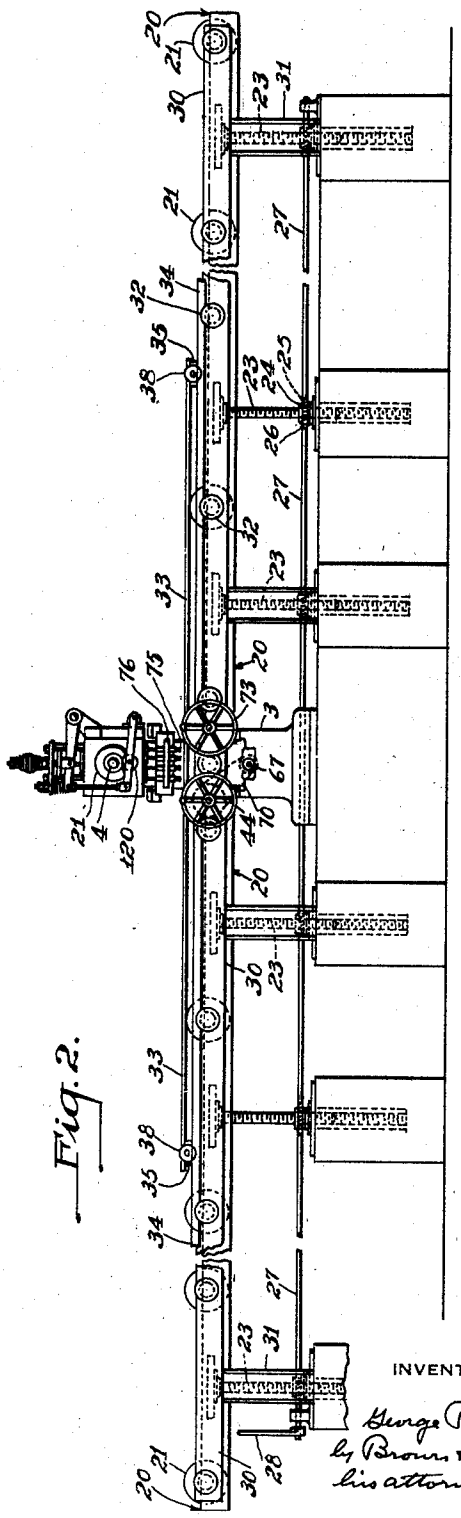


Fig. 2.

WITNESS
A. C. Wallace.

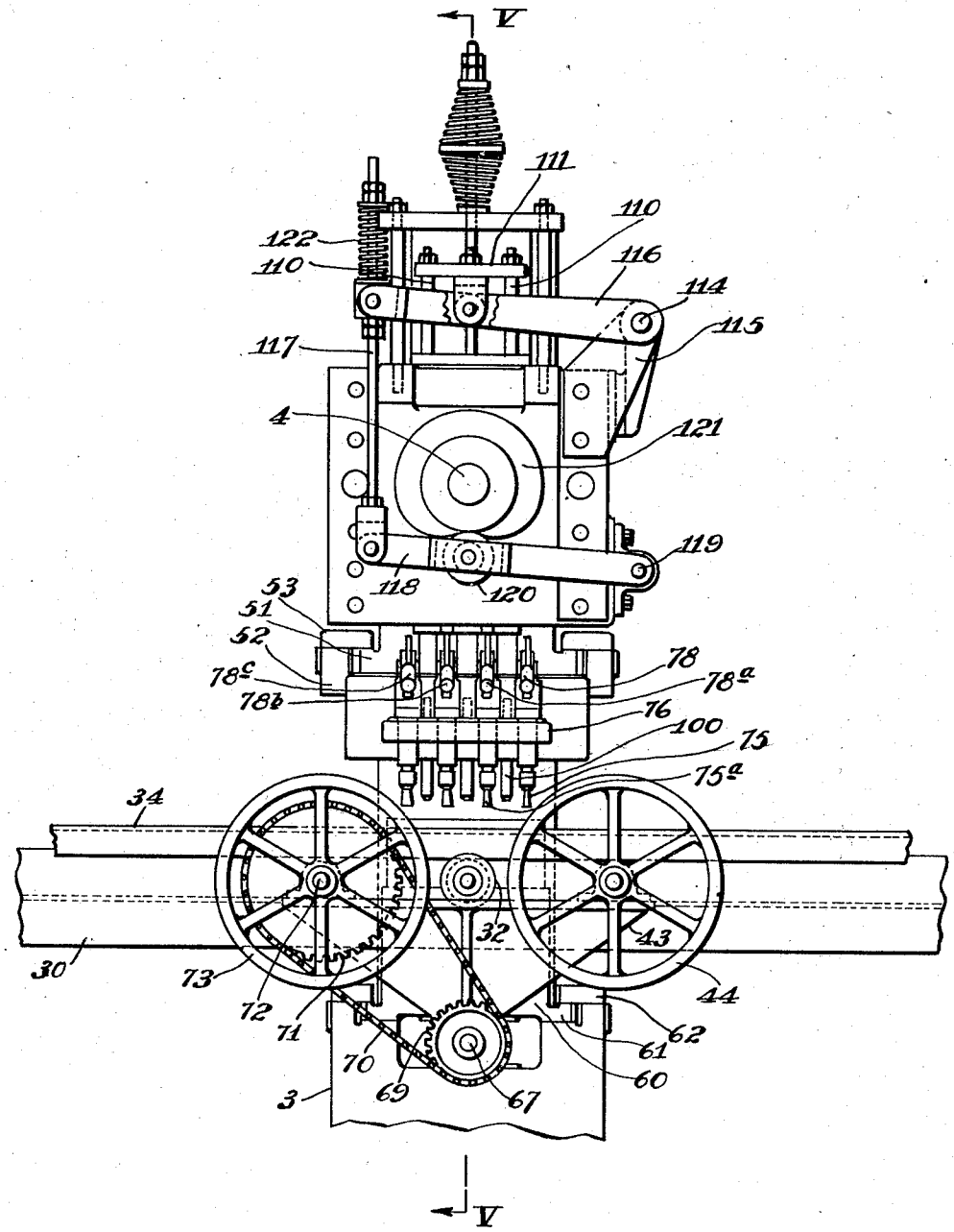
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METAL PERFORATING MACHINE

Filed Nov. 2, 1927 6 Sheets-Sheet 2

Fig. 3.



WITNESS
A. B. Wallace.

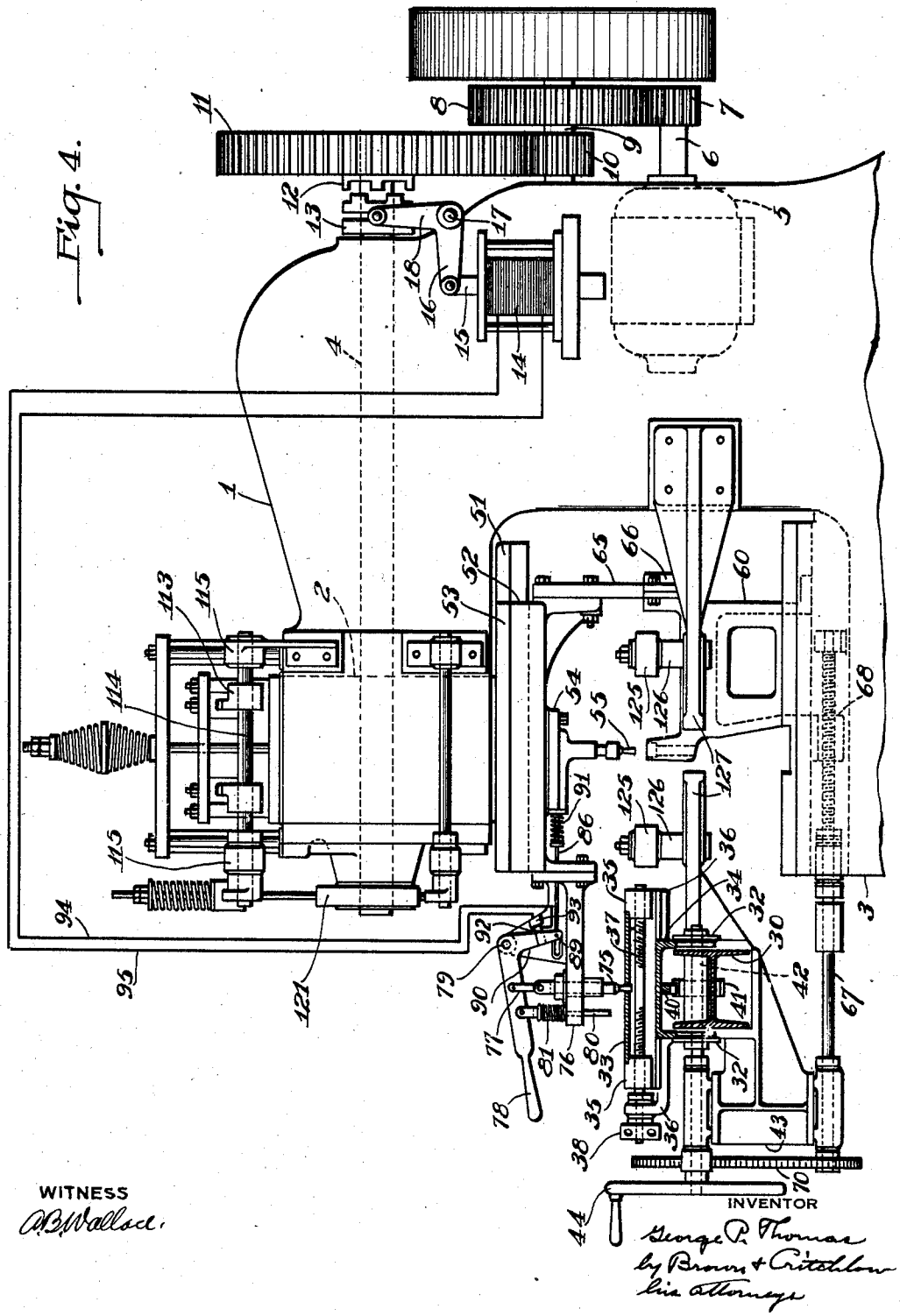
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METAL PERFORATING MACHINE

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Fig. 4.



WITNESS

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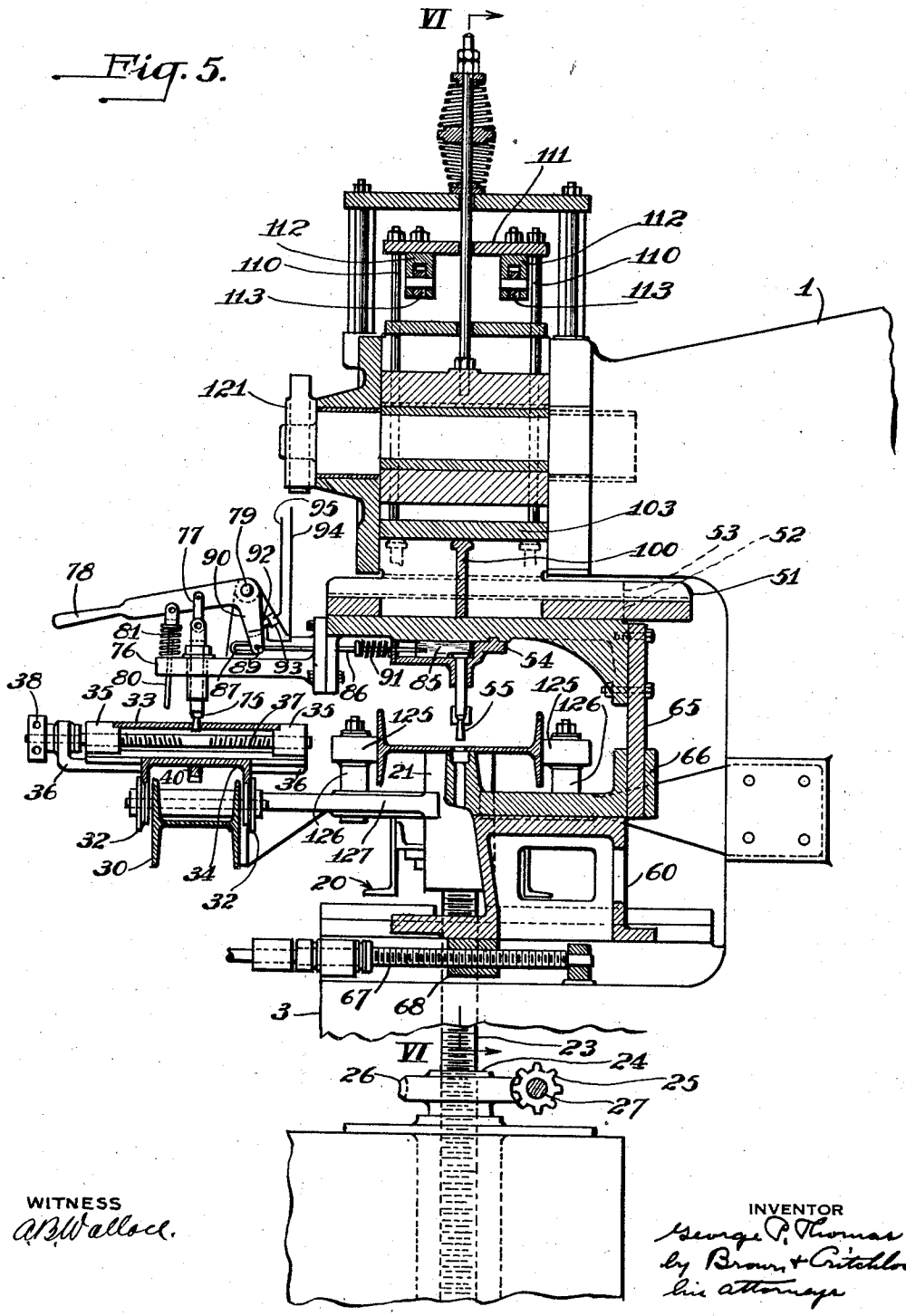
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METAL PERFORATING MACHINE

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Fig. 5.



WITNESS
A. B. Wallace.

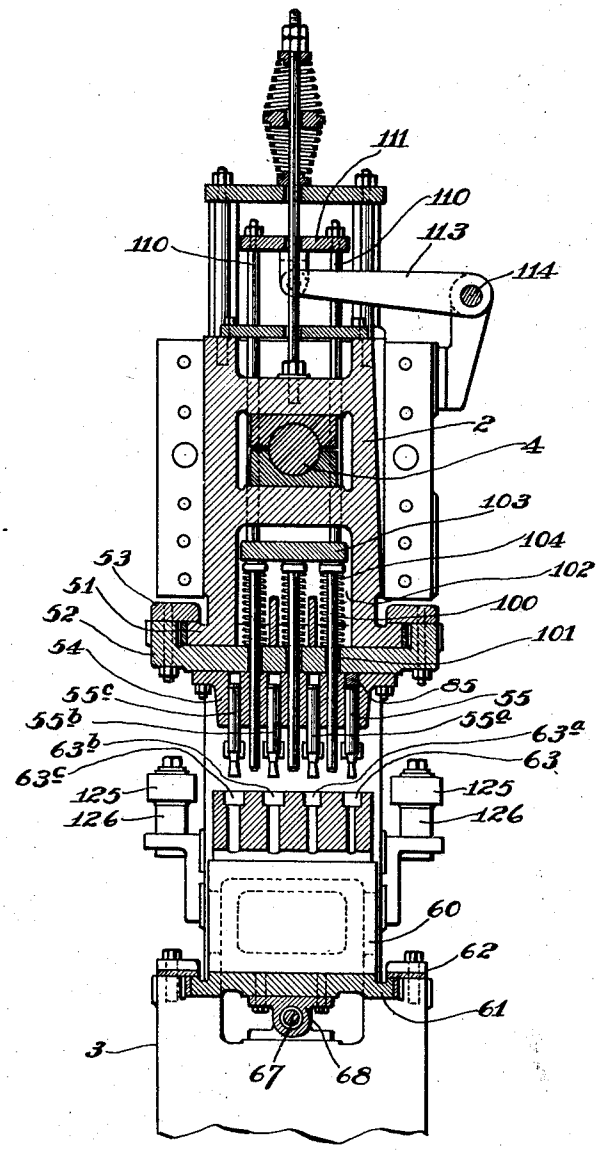
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METAL PERFORATING MACHINE

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Fig. 6.



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METAL PERFORATING MACHINE

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Fig. 8.

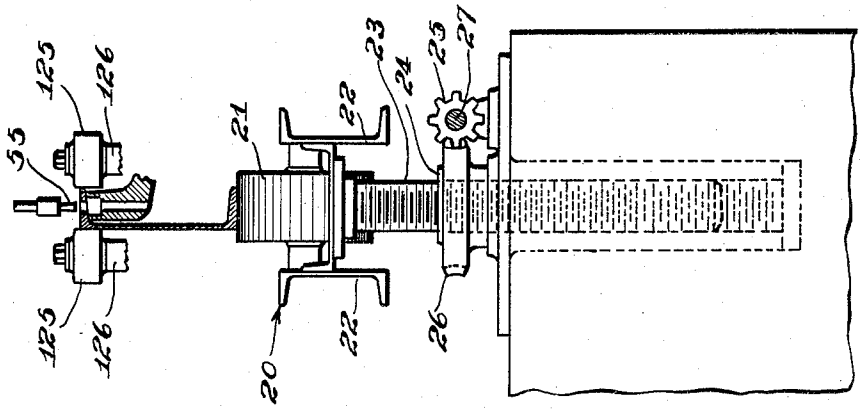
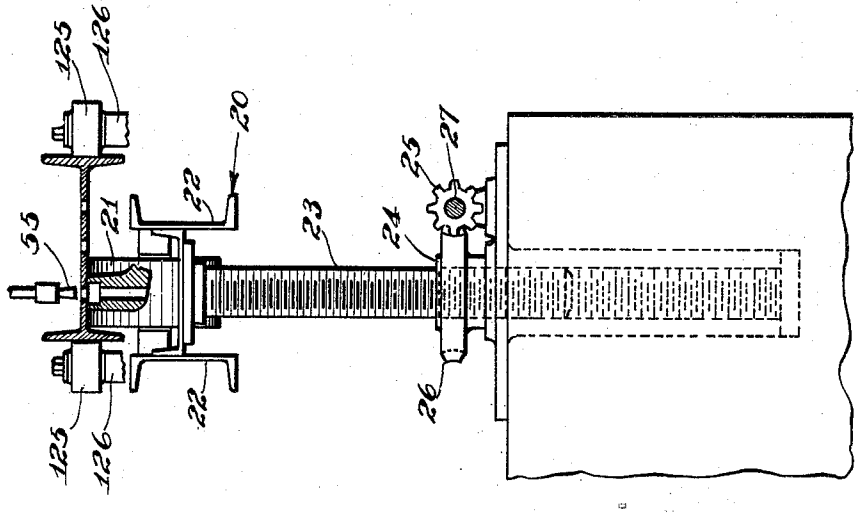


Fig. 7.



WITNESS

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Patented Sept. 9, 1930 1,775,359

UNITED STATES PATENT OFFICE

GEORGE P. THOMAS, OF GLENSHAW, PENNSYLVANIA

METAL-PERFORATING MACHINE

Application filed November 2, 1927. Serial No. 230,498.

The invention relates to machines for punching or perforating metal blanks, such as structural steel plates, angles, I-beams, channels, and the like. While some of the features of the invention are applicable to various types of metal perforating machines, others are particularly applicable to the general type of machines in which punch and die holders are mounted on a punching head and anvil for movements transversely of the line of movement of a blank through the machine.

An object of the invention is to provide a metal perforating machine in which a finder pin or equivalent blank-positioned member is movable transversely of a templet by and with transverse positioning movements of punch and die holders.

A further object is to provide a metal perforating machine, particularly, a machine in which punch and die holders are movable transversely of the line of feed of a blank, with a stripper which is actuated independently of the movements of a punching head, and which may be transversely moved with a punch holder to remain in proper relationship with a punch borne by the holder.

A further object is to provide an improved punching machine and work and templet support which are readily adjustable for punching different forms of structural sections, and different sizes of each form.

The invention is illustrated in the accompanying drawings, of which Fig. 1 is a somewhat diagrammatical plan view of a punching machine and a work and templet support associated with it; Fig. 2 an elevation of the machine and support shown in Fig. 1; Fig. 3 a front view to enlarged scale of the punching machine shown at the centers of Figs. 1 and 2; Fig. 4 an elevation of the right hand side of the punching machine as shown in Fig. 3; Fig. 5 a vertical sectional view taken on the line V—V, Fig. 3; Fig. 6 a vertical sectional view taken on the line VI—VI, Fig. 5; and Figs. 7 and 8 are vertical sectional views taken on the line VII—VII, Fig. 1 illustrating various adjustments of the punching machine and work support for punching different forms of structural sections.

The machine provided according to this invention includes a metal punch and a work and templet support associated with it. Either of these may be variously constructed throughout as far as concerns some features of the invention. As shown particularly in Figs. 1, 2 and 4, the punching machine comprises a frame 1 of the yoke type provided with a reciprocable punching head 2 adapted to be equipped with one or more punch holders, and also provided with an anvil 3 adapted to be equipped with one or more die holders. The punching head is reciprocated by an eccentric on a shaft 4 adapted to be rotated by a motor 5 through the clutch-controlled train of connections shown in Fig. 4. These connections comprise armature shaft 6, pinion 7, gear 8, shaft 9, pinion 10 and gear 11, which gear is rotatably mounted on the outer end of shaft 4. Gear 11 is provided with a clutch element 12 adapted to be engaged by a clutch element 13 which is splined to shaft 4 for longitudinal movement on it. Clutch element 13 may be, and preferably is, brought into engagement with clutch element 12 by means of an electro-magnet 14 having a movable armature 15 pivotally connected to an arm 16 attached to a rock shaft 17. To this shaft there is attached a yoke 18 which engages a groove in clutch element 13.

The work support preferably comprises a table 20 extending from each side of the punching machine and provided with a plurality of idle rollers 21 for supporting work. As shown in Fig. 7, the table may be formed on a pair of channels 22 arranged back to back with the rollers 21 mounted between them. Provision is made for raising and lowering the work table to properly support various blanks for punching. To this end, the table is preferably supported at the upper ends of a plurality of screws 23 each engaged by a nut 24 peripherally provided with a worm gear 25 which meshes with a worm 26 attached to a shaft 27 which may be rotated by suitable double-acting pawl and ratchet lever 28 or by any other suitable mechanism. By rotating shaft 27, nuts 24 are rotated upon screws 23 to raise or lower table 20.

At the side of work table 20 there is a templet supporting table 30, which also ex-

tends from each side of the punching machine. This table may take the form of an H-section or sections (Fig. 4) supported by posts 31 and provided with a plurality of idler rollers 32. A templet of any suitable form but preferably comprising a perforating plate, angle, or other structural section, is borne for longitudinal movement upon table 30. As shown particularly in Fig. 4, a templet 33 in the form of a perforated plate is preferably attached to a carriage in the form of a channel 34, the edges of the flanges of which rest upon rollers 32. At each end of carriage 34 there is a templet attaching clamp comprising clamping blocks 35 slidably mounted in brackets 36 attached to the carriage, the blocks having threaded engagement with a rod 37 oppositely threaded at its ends and rotatably mounted in brackets 36, the rod being provided at one end with a wrench head 38 for rotating it.

For moving templet carriage 34, it is provided on its lower face with a rack 40 engaged by a pinion 41 attached to templet-supporting table 30. Shaft 42 may be rotated to move templet carriage 34 by means of a hand wheel 44 which is positioned for convenient operation by a workman stationed at the front of the punching machine. At its forward end, templet carriage 34 has attached to it a suitable clamp 50, diagrammatically shown in Fig. 1, which extends laterally of the templet carriage and is equipped with suitable jaws for engaging work which is supported on rollers 21 of work table 20. Accordingly, longitudinal movements of the templet carriage effect corresponding longitudinal movements of the work being punched.

As has been previously indicated, the invention has to do with the provision of machines of the type thus shown and described, having punch and die holders which are movable transversely of the line of movement of a blank through the machine, with a finder pin or equivalent blank-positioned member which is simultaneously movable with the punch and die holders to engage laterally displaced points of a longitudinally movable templet. As shown in Figs. 3, 4, and 6 the lower end of reciprocating punch head 2 is provided with a shoe 51, on which there is slidably mounted a punch holder carriage 52, the shoe being provided with laterally extending flanges which are engaged by plates 53 attached to the carriage. Attached to the lower face of carriage 52 there is a punch holder 54 equipped with a plurality of punches 55, 55^a, 55^b, and 55^c, the several punches being of different sizes for use in punching different sized holes in blanks. Similarly, on the anvil portion 3 of punch frame 1 there is slidably mounted a die holder carriage 60 provided at its lower edge with outwardly extending flanges 61 which are engaged by plates 62 attached to the anvil. Die carriage 60 is provided with a die holder for receiving a plurality of dies 63, 63^a, 63^b and 63^c, adapted to cooperate with the several punches shown above them in Fig. 6.

Provision is made for simultaneously moving the punch and die holders laterally in such a manner that the punches and dies maintain their proper alignments. For interconnecting the punch and die holders, punch holder carriage 52 is preferably provided with a pin or bar 65 mounted for vertical reciprocation in a socket 66 attached to die holder carriage 60, bar 65 having a neat fit in socket 66 so that there will be no lost motion between the bar and socket when punch and die holders are moved laterally. Simultaneous transverse movements of the punch and die holders are preferably effected by rotatable shaft 67 which is threaded for engagement of cooperating threads formed in a block 68 attached to the lower face of die holder carriage 60. At its outer end, shaft 67 is provided with a sprocket wheel 69 (Fig. 3) engaged by a sprocket chain 70, which in turn engages a sprocket wheel 71 attached to a shaft 72 adapted to be rotated by a hand wheel 73 conveniently positioned for operation by a workman in front of the punching machine. Through the train of driving connections just explained the rotation of hand wheel 73 causes the punch and die holders to move laterally of the line of movement of a blank through the punching machine.

For cooperation with a templet 33 to position work for punching, there is a finder pin mechanism attached to the outer end of punch holder carriage 52. This mechanism preferably comprises a finder pin 75 mounted for vertical movements in a bracket 76 attached to carriage 52. At its upper end, pin 75 is connected by a link 77 to a hand lever 78 pivoted at 79 to bracket 76. For each punch 55, 55^a, etc., there is a finder pin 75, 75^a, etc., and a hand lever 78, 78^a, etc. For urging each lever 78 upwardly to move its attached finder pin above a templet, it is provided with a rod 80 extending downwardly through bracket 76 and engaged by a spring 81 extending between the bracket and a shoulder formed on the rod.

When a finder pin has been lowered into engagement with a perforation in templet 33, the desired punching operation may ensue without any delay. To avoid delay, and also to facilitate the operation of the machine, provision is made for rendering the required punching tool operative simultaneously with the entry of the finder pin into a templet perforation and for also simultaneously throwing the punch clutch to effect the reciprocation of the punching head. For rendering a punching tool operative, each is backed by a gag 85 (Fig. 5), to which there is attached

a rod 86 provided at its outer end with a slot 87 in which there is arranged a pin 89 attached to an arm 90 forming a part of hand lever 78. When lever 78 is depressed, its arm 90 moves towards the punching machine to place gag 85 back of punch 55, this movement being resisted by a spring 91 surrounding rod 86 so that when the punching pressure is released from gag 85 the spring will become effected to remove the gag from its punch-backing position.

For setting the punch in operation upon the depressing of hand lever 78 to cause its finder pin to enter a templet perforation, arm 90 is provided with a contactor 92 which engages a fixed contactor 93 for closing a circuit through conductors 94 and 95 extending to electromagnet 15. By thus closing a circuit through the electromagnet, clutch element 13 is brought into engagement with this cooperating element 12 to cause shaft 4 to rotate to reciprocate punching head 2. This circuit is broken as soon as the operator releases the lever 78 to permit spring 81 to raise the lever.

A further feature of this invention has to do with the provision of a stripper which, in the various lateral positions of the punching tool or tools, is effective for stripping blanks from the tools after a punching operation, and which is so constructed and operated that there will be no interference between it and any of the various forms of blanks which may be punched by the machine regardless of how close the punched holes may be to flanges of the blanks. For this purpose a stripper is mounted for vertical reciprocation in the reciprocating head of the punch, and means are provided in coordination with the head-reciprocating means for reciprocating the stripper.

In the illustrative embodiment of this feature of the invention, having reference particularly to Figs. 5 and 6, a plurality of strippers 100 are arranged, one between each adjacent pair of the several punches 55, 55ª, etc. and in alignment with them for vertical reciprocation through punch holder 54 and punch holder carriage 52, the carriage being provided with slots 101 to permit lateral movements of the stripper bars when the punch holder is moved laterally. Within a recess 102 formed in head 2 for receiving the upper ends of the stripper bars, there is a horizontally-disposed stripper-actuating plate 103 against the lower face of which each stripper bar is yieldingly urged by a spring 104.

Provision is made for so actuating plate 103 that the stripper bars are moved downwardly and maintained in their downward work-engaging positions independently of the reciprocation of head 2. For such purpose, plate 103 is attached at its corners to the lower ends of rods 110, the upper ends of which are attached to a cross frame 111 provided with a pair of depending brackets 112. To these brackets there are pivotally connected the outer ends of a pair of arms 113 secured to a rock shaft 114 attached by brackets 115 to punch frame 1. At the front of the machine shaft 114 has attached to it an arm 116, (Fig. 3) the outer end of which is connected by a rod 117 to the outer end of an arm 118, pivotally attached to the punch frame at 119 and provided intermediate of its ends with a roller 120 which bears upon the periphery of a cam 121 attached to the outer end of punch shaft 4. The upper end of connecting rod 117 is indirectly connected to the outer end of arm 116 through a spring 122 so that the stripper may be yieldingly pressed upon the top of a blank, and also so that the stripper actuating connections will not be broken by various exigencies of operation.

When the punches are in their inoperative upper positions, cam-engaging roller 120 lies in a depression of cam 121, arm 118 being urged upwardly by the springs 104 which act upon the stripper bars. When the punching machine is set in operation the rotation of cam 121 attached to shaft 4 depresses arm 118, which, through connecting rod 117, depresses arm 116 to rotate shaft 114, which in turn causes the outer ends of arms 113 to move downwardly and carry with them transverse frame 111. The downward movement of this frame causes rods 110 and their attached stripper plate 103 to move downwardly to press the strippers against a blank being punched. The strippers remain in this position until after the completion of a punching operation when they become released for upward movement, cam roller 120 then again resting in the depression of cam 121.

For maintaining blanks to be punched in proper alignment with the punching tools while passing beneath them, the punching machine is preferably provided with a plurality of idler rollers 125 (Figs. 4 and 5), each of which is carried by a support 126 mounted in a bracket 127 provided with a horizontally disposed slot so that each roller may be fixed in variable lateral positions. As illustrated in Fig. 5, these rollers are shown in fixed positions to properly engage the outer faces of flanges of an I-beam, and punch 55 and its cooperating die is in position for punching a hole in the center of the web of the beam. As illustrated in Fig. 7, the punch and die holder have been moved to the right near one flange of the beam, the web of the beam being supported by rollers 21 of work support 20. In Fig. 8, the work support 20 is shown in a lowered position for supporting the lower flange of a vertically disposed channel so that holes may be punched in its upper flange, rollers 125 being adjusted to engage the back of the channel and the edge of the upper

flange. From these relative positions of the work table, work-engaging rollers and punch and die holders, it will be seen that the machine may be readily adjusted for punching holes in plates, the web and flanges of I-beams and channels, and the legs of angles and other structural shapes.

In the operation of the machine, a templet 33 having perforations corresponding to the holes to be punched in a blank, is attached by clamp blocks 35 to templet carriage 34, and the forward end of the blank to be punched is attached through clamp 50 to the forward end of the templet carriage. The templet and blank are moved longitudinally through the machine by turning hand wheel 44 (Fig. 4), which, through shaft 42, pinion 41 and rack 40, moves the templet carriage. For adjusting the punch and die holders laterally of the longitudinal movements of the blank, hand wheel 73 (Fig. 3) is rotated, the driving connections from this hand wheel being through shaft 72, sprocket wheel 71, sprocket chain 70, sprocket wheel 69 and shaft 67 which engages die holder 60. Through socket 60 and sliding bar 65 attached to the punch holder carriage, the punch holder is moved laterally simultaneously with the die holder. This lateral movement of the punch and die holders is of such amount as to bring the required finder pin 75 in vertical alignment with a desired perforation in templet 33. When such alignment is effected, the proper hand lever 78 is depressed to cause its attached finder pin to enter the perforation, and also to position the required gag 85 beneath the punching tool. This movement of hand lever 78 also closes a circuit through conductors 94 and 95 to electromagnet 14 which throws clutch element 13 to set punching shaft 4 in rotation for reciprocating punch head 2. The rotation of shaft 4 also causes stripper bars 100 to move downwardly into engagement with a blank, this movement of the stripper being effected through cam 21 attached to shaft 4, which acts through the driving connections extending from such cam to stripper-actuating plate 103.

It is characteristic of the machine provided according to this invention that the entire operation of the machine may be easily controlled and effected by an operator standing directly in front of the machine where he can observe both the punching operation and the positioning of finder pins, and that regardless of the lateral positions of the punches and of the character of blanks being punched, a stripper is properly positioned for performing its function without interference with the blank.

According to the provisions of the patent statutes, I have explained the principle and operation of my invention, and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim as my invention:

1. In a metal perforating machine, the combination with an anvil and a vertically reciprocating punch head, of a die holder and a punch holder connected to each other for simultaneous horizontal movements and mounted on said anvil and head respectively, means for moving said die holder horizontally, a work and templet carriage horizontally movable transversely of the movements of said die and punch holders, and a finder pin attached to said punch holder for transverse movements therewith and mounted for vertical movements to and from engagement with a templet borne by said carriage, a punch gag mounted for horizontal movements in said punch holder, and a single means for moving said gag to back a punch and for moving said finder pin into engagement with a templet.

2. In a metal punching machine, the combination of a frame, a reciprocable punching head borne thereby, means for reciprocating said head, a punch holder mounted for horizontal movements on said head, a stripper mounted for vertical reciprocation in said punch holder and horizontally movable therewith, and means coordinated with said head-reciprocating means for reciprocating said stripper independently of the reciprocation of the head.

3. In a metal punching machine, the combination of a frame, a reciprocable punching head borne thereby, means for reciprocating said head, a punch holder mounted for horizontal movements on said head, a stripper bar mounted for vertical reciprocation in said punch holder, means for urging said stripper bar upwardly, and means coordinated with said head-reciprocating means for moving and maintaining said stripper downwardly independently of the reciprocation of said head.

4. In a metal punching machine, the combination of a frame, a reciprocable punching head borne thereby, means for reciprocating said head, a punch holder mounted for horizontal movements on said head, a horizontally disposed stripper-actuating plate borne by said head, a stripper bar mounted for vertical reciprocation in said punch holder and horizontally movable therewith, said bar engaging said plate at the variable horizontal positions of the bar, and means coordinated with said head-reciprocating means for reciprocating said stripper plate.

5. In a metal punching machine, the combination of a frame, a reciprocable punching head borne thereby, means for reciprocating said head, a punch holder mounted for hori-

zontal movements on said head, a horizontally disposed stripper-actuating plate borne by said head, a stripper bar mounted for vertical reciprocation in said punch holder and horizontally movable therewith, means for yieldingly urging the upper end of said stripper bar in bearing contact with said plate, and means coordinated with said head-reciprocating means for reciprocating said stripper plate.

6. In a metal punching machine, the combination of a frame, a reciprocable punching head borne by said frame, means including a rotary shaft provided with an eccentric for reciprocating said head, a punch holder mounted for horizontal movements on said head, a stripper mounted for vertical reciprocation in said punch holder and for horizontally moving therewith, and connections extending from said shaft to said stripper for moving the latter to stripping position.

7. In a metal punching machine, the combination of a frame, a reciprocable punching head borne by said frame, means including a rotary shaft provided with an eccentric for reciprocating said head, a punch holder mounted for horizontal movements on said head, a horizontally disposed stripper-actuating plate borne by and within said head, a stripper bar mounted for vertical reciprocation in said punch holder and horizontally movable therewith, means for urging said stripper bar upwardly, and connections extending from said shaft to said plate for moving said bar to stripping position.

8. In a metal perforating machine, the combination with an anvil and a reciprocating punch head, of a die holder and a punch holder mounted respectively on said anvil and head for simultaneous lateral movements transversely of the line of reciprocation of said head, a work and templet carriage longitudinally movable transverse of the lines of movement of said die and punch holders, and a finder pin mounted for movement to and from engagement with a templet borne by said carriage, said finder pin being connected to said punch holder for transverse movements therewith to simultaneously fix the longitudinal movements of said carriage and the lateral movements of said die and punch holder.

In testimony whereof, I sign my name.

GEORGE P. THOMAS.