

(No Model.)

2 Sheets—Sheet 1.

V. E. EDWARDS.

APPARATUS FOR CONTROLLING METAL CUTTING SHEARS.

No. 587,363.

Patented Aug. 3, 1897.

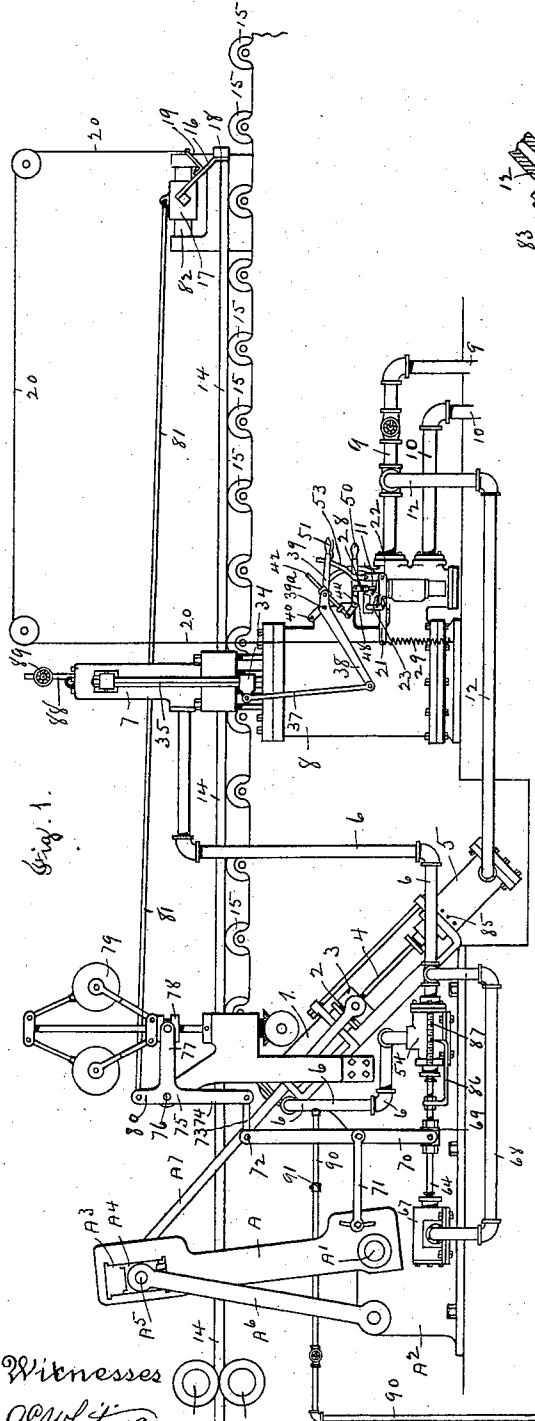


Fig. 1.

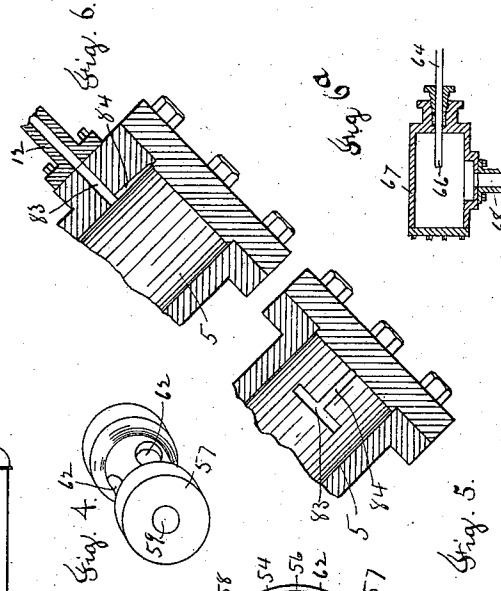


Fig. 2.

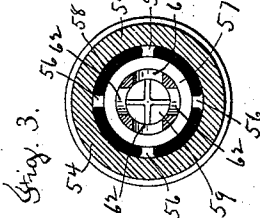


Fig. 3.

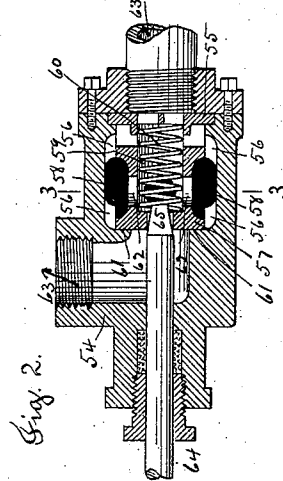


Fig. 4.

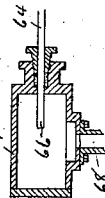


Fig. 5.

Fig. 6.

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By his Attorney

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Inventor  
Victor E. Edwards.

(No Model.)

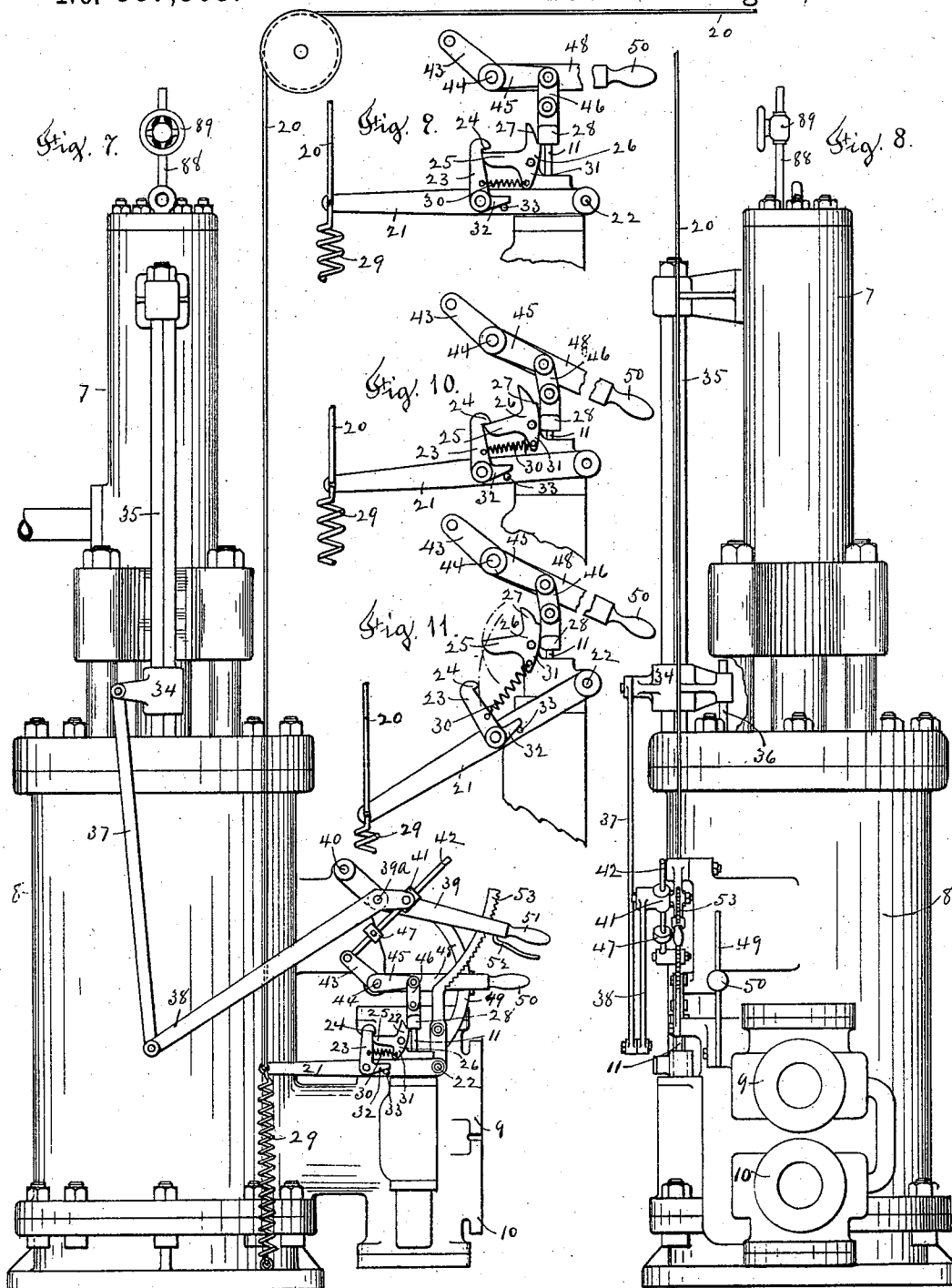
2 Sheets—Sheet 2.

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Witnesses  
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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR CONTROLLING METAL-CUTTING SHEARS.

SPECIFICATION forming part of Letters Patent No. 587,363, dated August 3, 1897.

Application filed July 15, 1895. Serial No. 556,093. (No model.)

*To all whom it may concern:*

Be it known that I, VICTOR E. EDWARDS, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a certain new and useful Improvement in Apparatus for Controlling Metal-Cutting Shears, of which the following is a specification, reference being had to the accompanying drawings, forming a part of the same and representing a metal-cutting shear and an apparatus for controlling the same embodying my present invention.

My present invention relates to that class of metal-cutting shears which are capable of moving with the rod or bar to be severed during the operation of cutting, so the shear-blades as they engage the bar will travel with the bar and at the same speed, thereby allowing the bar to be severed by the action of the shear-blades while in motion; and my present invention consists in an apparatus for controlling the movement of the shear in correspondence with the direction and speed of the moving bar during the period it is engaged by the shear-blades. The construction and operation of the shear itself forms no part of my present invention, and for the purpose of illustrating the nature of my present invention I have shown in the accompanying drawings that construction of a shear adapted for cutting metal bars while in motion which forms the subject of the Letters Patent of the United States granted to me September 26, 1893, No. 505,512, to which reference may be had for a detailed description of the shear, which is shown in side elevation in the accompanying drawings, in which—

Figure 1 represents a side elevation of the metal-cutting shear shown and described in the patent, No. 505,512, above referred to and a side elevation of the controlling apparatus embodying my present invention. Fig. 2 is a central sectional view of the check-valve and throttling-spindle by which the flow of water to the hydraulic cylinder is regulated, said figure showing a central vertical longitudinal sectional view of the shell or case inclosing the check-valve, and the inclosed check-valve with the throttling-spindle shown in full. Fig. 3 is a sectional view on line 3 3, Fig.

2. Fig. 4 is a detached and perspective view of the spool-shaped check-valve. Fig. 5 shows a central sectional view of the lower end of the steam-cylinder. Fig. 6 is a central sectional view of the lower end of the steam-cylinder on a plane at right angles to the plane of the section shown in Fig. 5. Fig. 6<sup>a</sup> is a central sectional view of the counterbalancing-cylinder for counterbalancing the pressure upon the throttling-spindle. Fig. 7 is a side view of the "intensifier," showing the valve-controlling mechanism upon a larger scale than is represented in Fig. 1. Fig. 8 is a side view of the same, the view being shown at right angles to that represented in Fig. 7; and Figs. 9, 10, and 11 show certain portions of the valve-controlling mechanism with the parts represented in different positions.

Similar letters and numerals refer to similar parts in the different figures.

Referring to the drawings, A denotes the frame of a metal-cutting shear of the construction shown and described in Letters Patent of the United States No. 505,512, granted to me September 26, 1893.

The frame A is pivoted at one end at A' to a supporting-bed or framework A<sup>2</sup>, and at the opposite end it is provided with ways A<sup>3</sup>, in which are held sliding blocks, one of which is shown at A<sup>4</sup>.

The sliding blocks A<sup>4</sup> carry a spindle A<sup>5</sup>, connected at its ends to the bed A<sup>2</sup> by means of links, one of which is shown at A<sup>6</sup>. The upper end of the frame A is connected with a reciprocating cross-head by means of links, one of which is shown at A<sup>7</sup>, the reciprocating motion of the cross-head rocking the frame A upon its pivot A', and the forward rocking motion of the frame A causes a sliding motion of the blocks A<sup>4</sup> in the ways A<sup>3</sup>. A fixed shear-blade is carried by the frame A and a movable shear-blade is carried by a block mounted upon the spindle A<sup>5</sup>, (neither of which is shown,) so the sliding motion of the blocks A<sup>4</sup> and spindle A<sup>5</sup> will cause the shear-blades to act in conjunction in cutting a metal bar inserted between them and during the forward swinging movement of the frame A, as fully described in the patent aforesaid, No. 505,512, to which reference may be had for a detailed description of the shear.

The shear is actuated by a hydraulic cylinder 1, containing a single-acting piston 2, connected with a reciprocating cross-head 3, which is connected by links A<sup>7</sup> with the frame 5 A of the shear. Attached to the cross-head 3 is a piston-rod 4, carrying a single-acting piston (not shown) inclosed in a steam-cylinder 5.

The hydraulic cylinder 1 is connected by a pipe 6 with an intensifier, comprising a cylinder 7, filled with water, and a steam-cylinder 8, each inclosing pistons carried upon a common piston-rod. Steam is admitted to the steam-cylinder 8 through a steam-pipe 9, leading to the boiler, and is exhausted through an exhaust-pipe 10, the steam being controlled by means of a valve, which may be of any known type of reciprocating valve carried upon a valve-stem 11.

As steam is admitted to the steam-cylinder 8 its steam-piston is forced upward, carrying the piston in the water-cylinder 7 and forcing the water contained therein through the pipe 6 to the hydraulic cylinder 1, moving the cross-head 3 down and imparting a forward rocking motion to the frame A of the shear and bringing the shear-blades together, severing the bar inserted between them. The steam-cylinder 5 communicates freely with the steam-boiler through a steam-pipe 12, connecting the cylinder 5 with the steam-pipe 9, leading to the boiler, or the steam-pipe 12 can connect directly with the boiler, if desired, thereby admitting steam at boiler-pressure to the steam-cylinder 5. As the cross-head 3 moves down, the piston in the cylinder 5 is also forced down, driving the steam from the cylinder 5 back into the boiler, and as the steam is exhausted from the steam-cylinder 8 the pressure of steam in the cylinder 5 forces its piston upward, sliding the cross-head 3, forcing the water in the cylinder 1 back through the pipe 6 into the water-cylinder 7, and also reversing the rocking motion of the shear-frame A, carrying it back into the position as represented in Fig. 1 of the drawings. The action of the shear is therefore determined by the movement of the steam-valve carried upon the reciprocating valve-stem 11, and this valve-stem is operatively connected with the moving rod or bar to be cut, so that whenever a certain length of rod has passed between the shear-blades the valve-stem 11 is moved to admit steam to the cylinder 8 and rock the shear-frame A and sever the rod, as described.

13 denotes a pair of rolls by which the rod 14 is delivered to the shear at a determinate rate of speed, and 15 are revolving rolls forming a table upon which the rod is supported as it is severed by the shear and by which the severed piece is moved away from the shear.

Arranged in front of the shear and at the proper distance therefrom, according to the length of the rod to be cut, is a tripping-finger 16, pivoted at one end upon a block 17

and having its opposite end 18 weighted and hanging in the path of the moving rod 14.

Projecting from the finger 16 is an arm 19, connected by a flexible connection 20 with one end of a lever 21, Fig. 7, pivoted at its opposite end upon a fixed stud 22 and carrying a pivoted latch 23, provided with a hook 24, which hooks over the horizontal arm 25 of a lever 26, pivoted upon a fixed stud and having a vertical arm 27, engaging a head 28 of the valve-stem 11, supporting the stem and its valve in a raised position, in which the steam-pipe 9 is closed and the exhaust-pipe 10 open. The free end of the lever 21 is connected by means of a spring 29 with the framework, whereby the tension of the spring 29 is applied to draw the lever 21 downward, acting against the weighted finger 16, which is heavy enough to overcome the tension of the spring 29 and hold the lever 21 in a horizontal position, as represented in Figs. 7 and 9.

Whenever the end of the moving rod 14 strikes the finger 16, it raises the end 18, allowing the spring 29 to draw the lever 21 downward into the position shown in Fig. 10, the downward motion of the lever 21 rocking the lever 26 by means of the hooked latch 23 and carrying the vertical arm 27 out from under the head 28 of the valve-stem 11, allowing the valve-stem and valve to fall by their own weight, closing the exhaust-pipe 10 and opening the steam-pipe 9, admitting steam to the cylinder 8 and starting the shear to sever the rod 14. The further downward motion of the lever 21 draws the hooked end of the latch 23 off the arm 25 of the lever 26, as shown in Fig. 11, when a spring 30, uniting the latch 23 with an arm 31, depending from the pivoted lever 26, rocks the lever 26 and holds its vertical arm 27 against the head 28 of the valve-stem and in position to be carried under the head 28 by the tension of the spring 30 whenever the valve-stem 11 is raised.

The latch 23 is held from being rotated by the strain of the spring 30 by means of an arm 32, extending from the latch 23 and resting upon a pin 33, held in the lever 21.

The admission of steam to the cylinder 8 raises its piston and sets the shear in motion, and as the piston inclosed in cylinder 8 rises it moves a slide 34 upon the rod 35 by means of a rod 36, which is lifted by the piston in the cylinder 8 and which carries the slide 34. The slide 34 is connected by a link 37 with a lever 38, which is pivoted at 39<sup>a</sup> upon a lever 39, pivoted upon a fixed stud 40, held by the frame of the machine. To the end of the lever 38 is pivoted a sleeve 41, capable of sliding on a rod 42, which is pivotally connected to an arm 43, carried upon a rocking shaft 44, journaled in the framework. The rocking shaft 44 carries an arm 45, which is connected by a link 46 with the head 28 of the valve-stem 11.

A collar 47 is adjustably attached to the rod 42, and as the lever 38 is rocked by the upward motion of the slide 34 the sleeve 41 is

5 moved along the rod 42 until it comes in contact with the collar 47, when the rocking motion of the lever 38 will rock the shaft 44 and raise the valve-stem 11, and as the valve-stem is raised the vertical arm 27 of the pivoted lever 26 will be carried under the head 28 by the tension of the spring 30, holding the valve-stem in its raised position and closing the steam-pipe 9 and opening the exhaust-pipe 10, 10 allowing the pressure of steam in the steam-cylinder 5 to reverse the motion of the shear and carry it into position for the next cut.

15 The rolls 15, which form a supporting-table for the piece severed from the rod, are positively rotated, so as to carry the severed piece away at a higher speed than that of the rod 14, in order to produce a gap between the severed piece and the advancing end of the rod.

20 The severed piece is carried by the rolls beneath the finger 16, and in the interval which is secured between the rear end of the severed piece and the forward end of the rod the finger 16 will fall into its normal position with the end 18 in the path of the advancing rod. When the end 18 of the finger 16 is permitted to fall by the passage of the severed 25 piece of rod, it raises the free end of the lever 21, overcoming the tension of the spring 29 and raising the latch 23, so the hook 24 will be again carried over the end of the arm 25 of the lever 26, as shown in Figs. 7 and 9.

30 The rocking shaft 44 is provided with a lever 48, which swings over a fixed arc 49 and has a handle 50 by which the valve-stem 11 can be raised by the operator. The lever 38 is pivoted upon a lever 39, pivoted upon a fixed stud 40 and provided with a handle 51 and a latch 52, by which the lever 39 is adjustably held upon a notched arc 53, allowing the pivot 39<sup>a</sup> to be raised or lowered 40 in order to allow the operator to vary the time of contact of the sleeve 41 with the collar 47 and determine the point of cutting off steam from the cylinder 8. The finger 16, 45 placed in the path of the advancing rod 14, serves as a measuring device, but it will be obvious that many devices can be employed to set the shear in motion at any predetermined period of time. In order to move the 50 shear-frame A at the same speed as that of the moving rod during the engagement of the shear-blades with the rod, I introduce a throttling mechanism into the pipe 6, connecting the hydraulic cylinder 1 with the water-cylinder 7 of the intensifier, consisting of a shell 54, inclosing a chamber 55, upon the inner 55 walls of which project lugs 56. The parallel edges of the lugs 56 form ways for a spool-shaped check-valve 57, which is surrounded 60 by an annular space 58. The check-valve 57 is provided with a concentric hole 59, extending longitudinally through the valve, a portion of the hole 59 being enlarged to receive the spiral spring 60, with its tension exerted 65 to hold the valve 57 against the end wall 61 of the chamber 55. The valve 57 is also provided with radial holes 62, forming a com-

munication between the annular space 58 and the concentric hole 59.

Water in passing from the water-cylinder 70 7 to the hydraulic cylinder 1 in the direction of the arrows 63 63, Fig. 2, passes through the concentric hole 59.

The hole 59 is throttled by means of a spindle 64, having a tapering end 65 and entering the shell 54 in alinement with the concentric hole 59. In order to balance the spindle 64, its opposite end 66 enters a closed water-cylinder 67, communicating by means of a pipe 68 with the pipe 6, so the water-pressure upon both ends of the spindle will be equal. 80

A collar 69 is adjustably attached to the spindle 64 and pivoted to the end of a lever 70, connected by a link 71 with the shear-frame A. The upper end of the lever 70 is pivoted at 72, so the forward motion of the shear-frame A will carry the tapered end 65 of the spindle 64 into the concentric hole 59 and contract the water-passage. The back-flow of water from the hydraulic cylinder 1 to the water-cylinder 7 will move the check-valve 57 back, compressing the spring 60 and allowing the water to flow around the check-valve and through the annular space 58. The upper end of the lever 70 is pivoted to a link 73, connecting it to an arm 74 of a three-armed lever 75, pivoted at 76 to the fixed framework. The arm 77 of the lever 75 is connected to the sliding collar 78 of a ball-governor 79, 100 driven by the same power which drives the rolls 13, so that any fluctuations in the speed of the rolls 13 will rock the lever 75 and rock the lever 70 about its pivotal connection with the link 71 and slide the spindle 64, 105 so as to make the amount of throttling of the water-passage controlled by the speed of the rolls 13 as well as by the forward movement of the shear-frame A. As the speed of the rolls 13 varies, it becomes necessary to also 110 vary the time of setting the shear in motion, as the rod 14 travels farther at a high speed during the interval required to move the shear after the finger has been raised or during the period of lost motion in operative mechanism, 115 and to compensate for the increased travel of the rod as the speed is increased I connect the third arm 80 of the lever 75 by means of a link 81 with the sliding block 17, upon which the finger 16 is pivoted, so that an increase 120 in the speed of the rolls 13 will draw the block 17 along the bar 82 nearer the shear, so the end 18 of the finger will be struck earlier by the end of the rod 14.

The steam-cylinder 5 is supplied with steam 125 at boiler-pressure through the pipe 12 and the opening 83 a short distance above the lower end of the cylinder, and from the opening 83 a groove 84 is formed in the inner surface of the cylinder, extending to the end of the cylinder and gradually decreasing in depth toward the end of the cylinder. As the piston of the cylinder 5 moves down the steam is forced through the opening 83 back toward 130

the boiler until the piston covers the opening 83, when the steam still remaining in the end of the cylinder will be forced through the groove 84, and the steam-passage becomes  
 5 more contracted as the piston approaches the end of the cylinder, forming an elastic cushion, which checks the momentum of the moving parts of the mechanism.

The cylinder 5 is provided with a series of  
 10 air-holes 85 to admit air to the upper side of the piston, and the sliding spindle 64 has an indicator-finger 86 adjustably attached and extending over a fixed and graduated scale-bar 87, in order to enable the throttling-spindle  
 15 to be properly adjusted.

The conditions under which it is necessary to control the speed of the shear are subject to great extremes of variation due to the changes in the speed of the rolls and also to  
 20 the variation in the size and temperature of the rod, and I have found it impracticable to secure a close adjustment of the speed of the shear by simply varying the area of the water-passage to the hydraulic cylinder, and I  
 25 have found it necessary to employ water in the intensifier having a pressure largely in excess of the pressure required in the hydraulic cylinder to overcome the resistance of the shear and to consume this excess in  
 30 pressure in the friction of the water as it passes the throttling-spindle, and my system or method of control contemplates the employment of a pressure in the intensifier largely in excess of the pressure required in  
 35 the hydraulic cylinder and by extreme throttling of the water-passage consume the excess of pressure in overcoming the friction of the moving water. This method causes the water soon to become too much heated for  
 40 use, and I effect a change in the volume of water employed by means of an eduction-pipe 88, having a restricted outlet and a check-valve 89, so that as the piston of the water-cylinder 7 is raised a portion of the water will  
 45 be forced out through the eduction-pipe 88.

The water-pipe 6 is connected with a water-main or other source of cold-water supply under pressure by means of a pipe 90, provided with a check-valve 91, and as the water  
 50 moves back from the hydraulic cylinder 1 to the water-cylinder of the intensifier cold water will flow through the pipe 90 and reduce the temperature of the volume of water employed.

In case the rolls 13 are driven by an engine having a heavy balance-wheel, their speed will be nearly uniform, and the governor may in such cases be omitted. The throttling-spindle 64 can also be disconnected from the  
 60 rocking shear-frame and moved into the shell 54 by the hand of the operator such a distance indicated upon the graduated scale-bar 87 as will secure the desired speed of the shear. It will be obvious that other mechanism than the pivoted tripping-finger 16 can  
 65 be employed to set the shear-actuating mechanism in motion and also that modifications

can be made in the intermediate mechanism between the tripping-finger 16 and the valve-stem 11, and I therefore do not wish to confine myself to the specific mechanism shown. 70

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination with a pair of rolls by which a rod, or bar, is delivered to a shear at  
 75 a speed determined by the speed of the rolls, of a shear capable of being moved with said rod, or bar, during the operation of cutting, mechanism for moving said shear in correspondence with the moving rod, or bar, but  
 80 independently thereof, a speed-governor driven in correspondence with the speed of said rolls, said speed-governor being operatively connected with said shear-moving  
 85 mechanism, whereby the speed of the shear is controlled and varied in correspondence with the speed of said rolls, substantially as described.

2. The combination with a pair of rolls, by which a rod or bar is delivered to a shear, of  
 90 a shear capable of moving parallel with the axis of said rod, or bar, during the operation of cutting, mechanism by which a force is applied to move said shear independently of the moving rod or bar, a tripping-finger placed  
 95 in the path of the moving rod or bar and capable of being moved out of said path by the movement of the rod, or bar, said finger being operatively connected with the shear-moving  
 100 mechanism, whereby said shear-moving mechanism is set in operation by the contact of the moving rod with said finger, substantially as described.

3. The combination with a pair of rolls by which a rod, or bar, is delivered to a shear capable  
 105 of moving with said rod, or bar, mechanism for moving said shear with the rod, or bar, and independently thereof, a finger placed in the path of said moving rod, or bar, and operatively connected with said shear-moving  
 110 mechanism, and a series of rolls arranged to receive the severed rod, or bar, and means for rotating said rolls at a speed greater than the speed of said delivery-rolls, substantially  
 115 as described.

4. The combination with a pair of rolls by which a rod or bar is delivered to a shear, and a shear capable of moving with said rod or bar during the operation of cutting, of a hydraulic cylinder operatively connected with  
 120 said shear, a pipe connecting said hydraulic cylinder with a source of water-supply under pressure, throttling mechanism by which friction is applied to the water entering said hydraulic cylinder, an eduction-pipe of limited  
 125 area through which a portion of the volume of water is forced out as it passes into said hydraulic cylinder and an inlet-pipe of limited area leading to a cold-water supply, through which a supply of cold water is admitted,  
 130 whereby the said water-supply is gradually changed so as to prevent undue heating, substantially as described.

5. The combination with a pair of rolls by

which a rod, or bar, is delivered to a shear and a shear capable of moving with said rod, or bar, during the operation of cutting, a hydraulic cylinder operatively connected with said shear, a pipe connecting said cylinder with a source of water-supply under pressure, a throttling mechanism by which a variable friction can be applied to the water passing through said pipe, mechanism by which said shear and said throttling mechanism are operatively connected, whereby the amount of friction upon the moving water is controlled by the movement of the shear, substantially as described.

6. The combination with a metal-cutting shear comprising a moving shear-frame and a hydraulic cylinder for actuating said shear, of a pipe leading from said hydraulic cylinder to a source of water-supply under pressure, a throttling mechanism by which the flow of water through said pipe is restricted, said throttling mechanism comprising a sliding tapered spindle, a lever pivotally connected at one end to said spindle and having its opposite end connected to a governor, a governor and a link connecting said shear-frame with said lever between its pivoted ends, whereby said spindle is controlled jointly by said governor and said moving shear-frame, substantially as described.

7. The combination with a pair of rolls by which a rod, or bar, is delivered to a shear, and a shear capable of moving with said rod, or bar, during the operation of cutting, of mechanism for moving said shear with the moving rod, a finger placed in the path of the moving rod and operatively connected with said shear-actuating mechanism, whereby the movement of said shear is controlled by the contact of said finger with the end of said rod, a sliding block carrying said finger and a governor operatively connected with said sliding block to move said finger along in the path of the moving rod and change its position, as the speed of the rod varies, substantially as described.

8. The combination with a pair of rolls by which a rod, or bar is delivered to a shear, of a shear capable of moving parallel with the axis of said rod, or bar during the opera-

tion of cutting, actuating mechanism for moving said shear parallel with the moving rod or bar, a tripping-finger placed in the path of said rod or bar and capable of being moved out of said path by the movement of the rod or bar, said finger being operatively connected with said shear-moving mechanism and a series of rotating rolls placed in front of said shear by which the severed rod or bar is carried past said finger, substantially as described.

9. The combination with a metal-cutting shear, and a hydraulic cylinder and inclosed piston operatively connected with said shear to actuate the same, of a source of water-supply under pressure, a pipe leading to said cylinder from said water-supply, a shell or case in said pipe, inclosing a valve-chamber, lugs projecting from the inner wall of said chamber and provided with parallel edges forming guides for a sliding check-valve, a check-valve inclosed between said lugs and capable of a sliding motion in said chamber, radial water-passages and a concentric longitudinal water-passage in said sliding valve and a spring to move it against a valve-seat and a valve-seat, substantially as described.

10. The combination with a metal-cutting shear, and actuating mechanism operatively connected with said shear, and comprising a steam-cylinder 8, of a steam-supply pipe and an exhaust-pipe communicating with said cylinder, a valve-stem 11 carrying a valve by which the flow of steam is controlled in said supply and exhaust pipes, a pivoted lever 26, by which said valve-stem is held at one end of its movement, a pair of rolls by which a rod, or bar, is delivered to said shear, a finger placed in the path of said rod, or bar, and intermediate connecting mechanism between said finger and said lever 26, whereby said valve-stem is released by the contact of said finger with the end of said rod, or bar, substantially as described.

Dated this 9th day of July, 1895.

VICTOR E. EDWARDS.

Witnesses:

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