No. 762,683. PATENTED JUNE 14, 1904.

E. H. CARROLL.

VALVE.

APPLICATION FILED JULY 8, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 2.

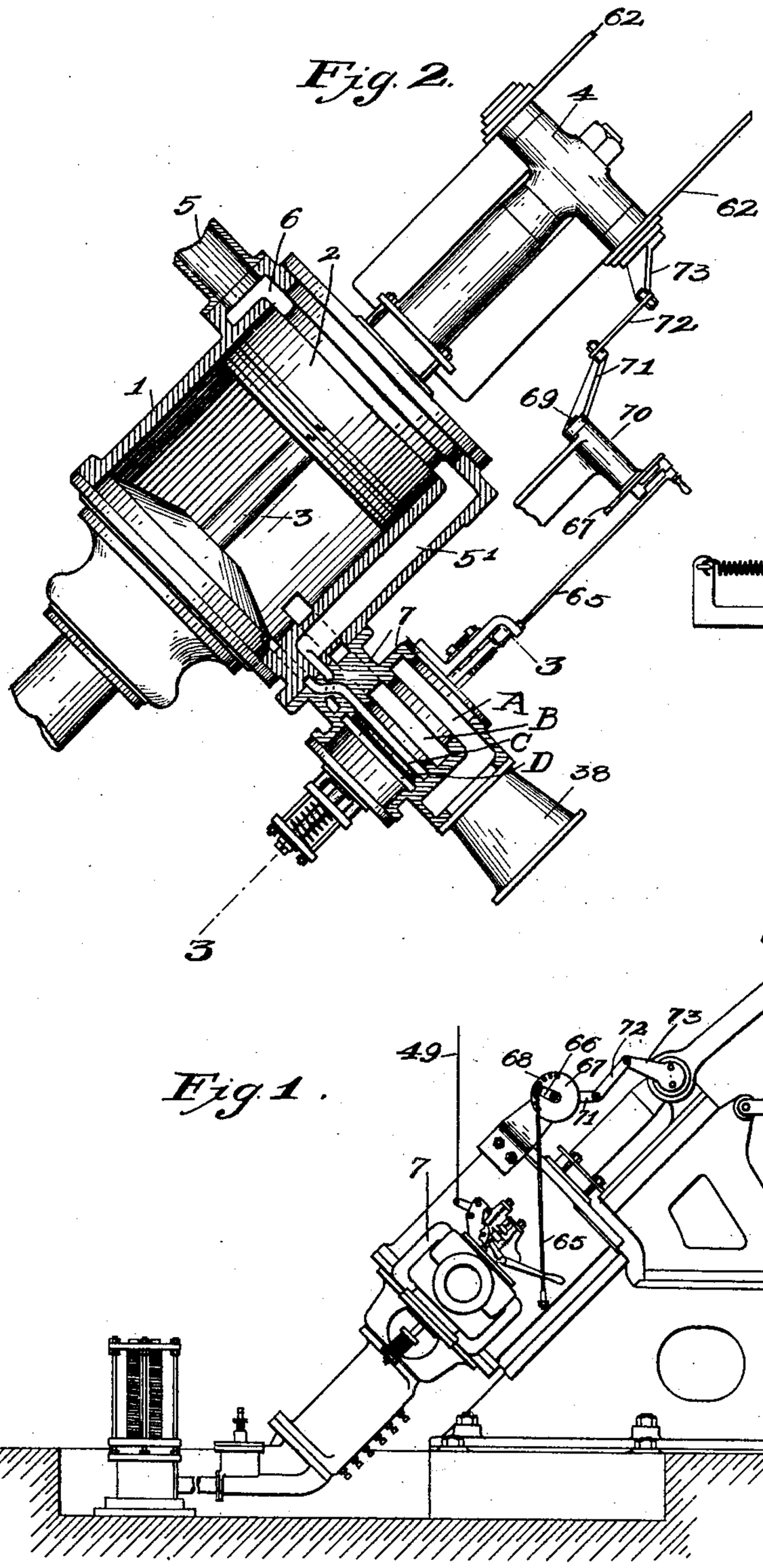

Fig. 9.

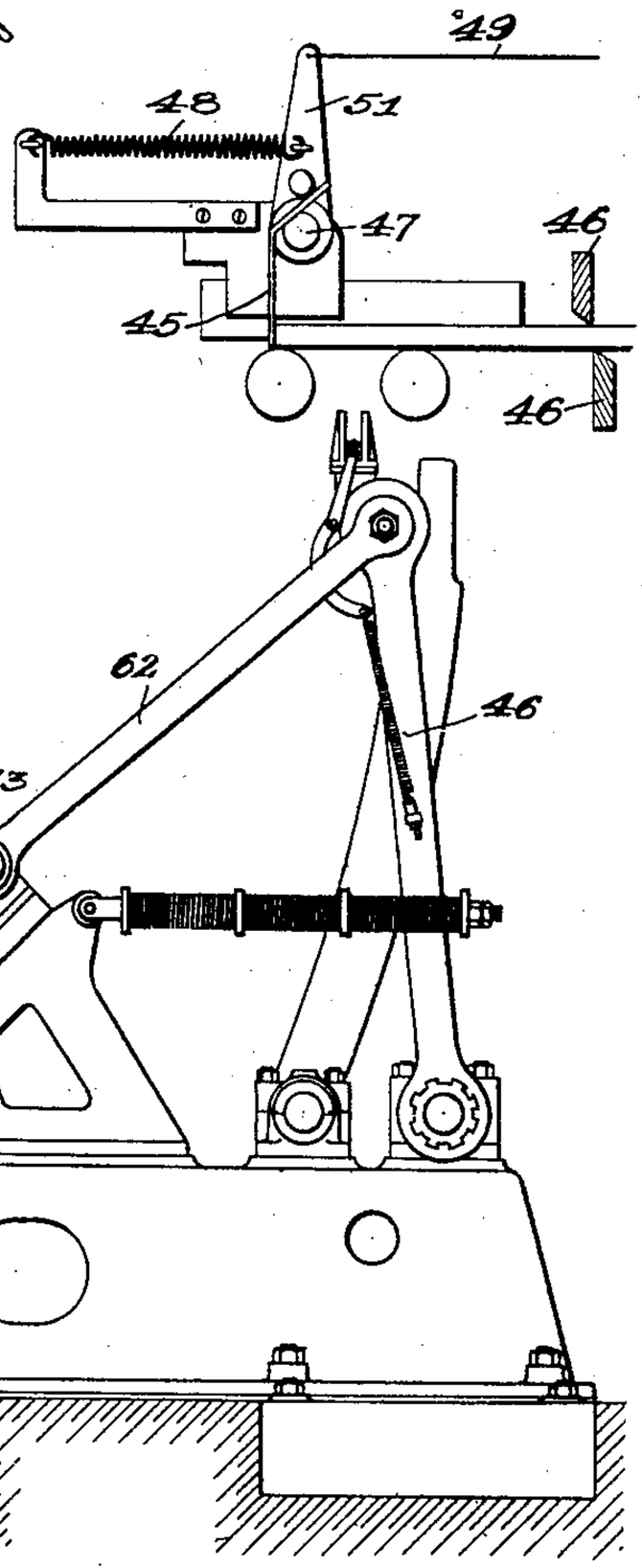

Fig 1.

Witnesses

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2 SHEETS—SHEET 2.

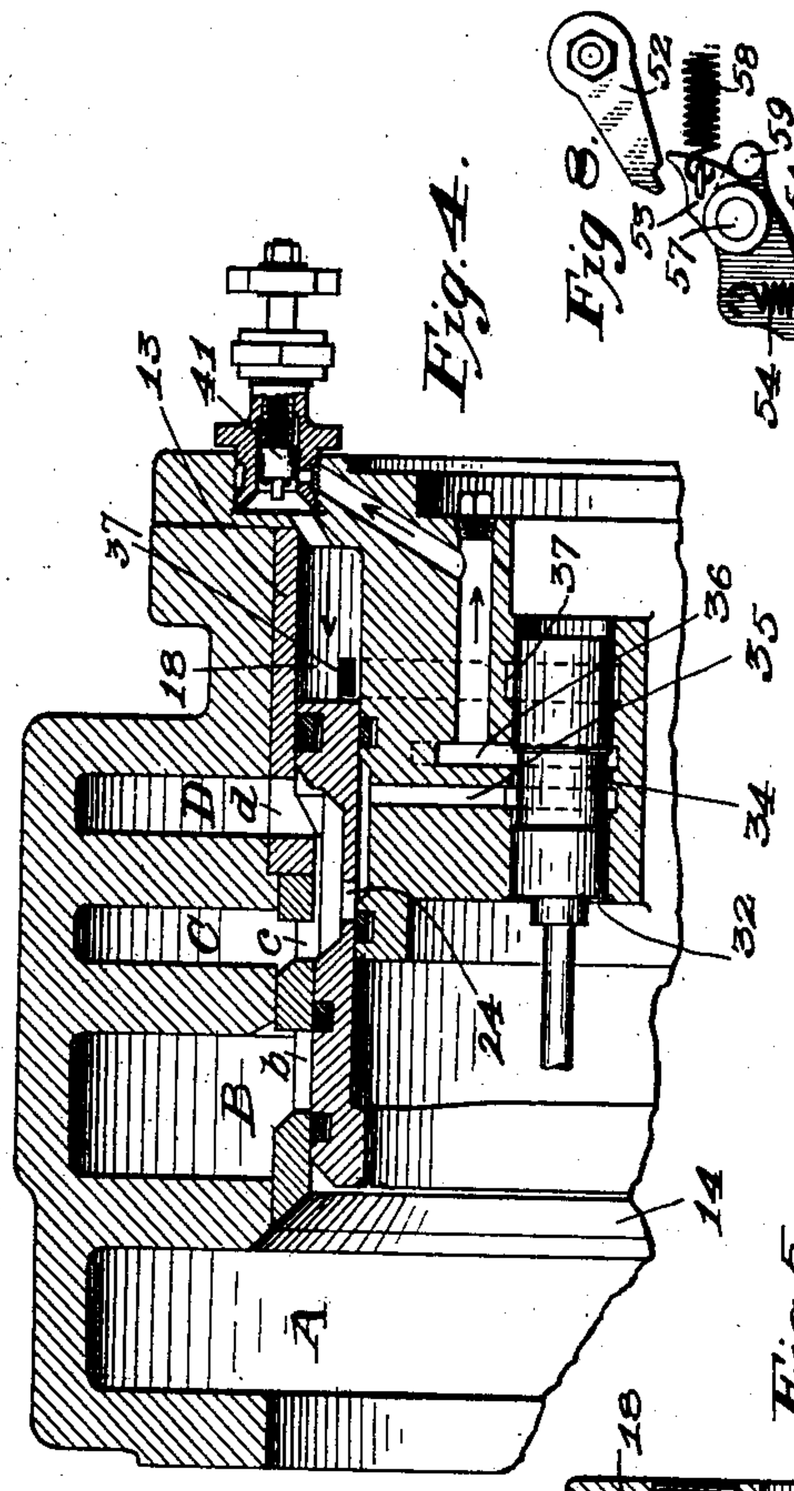

Fig. 4.

Fig. 5.

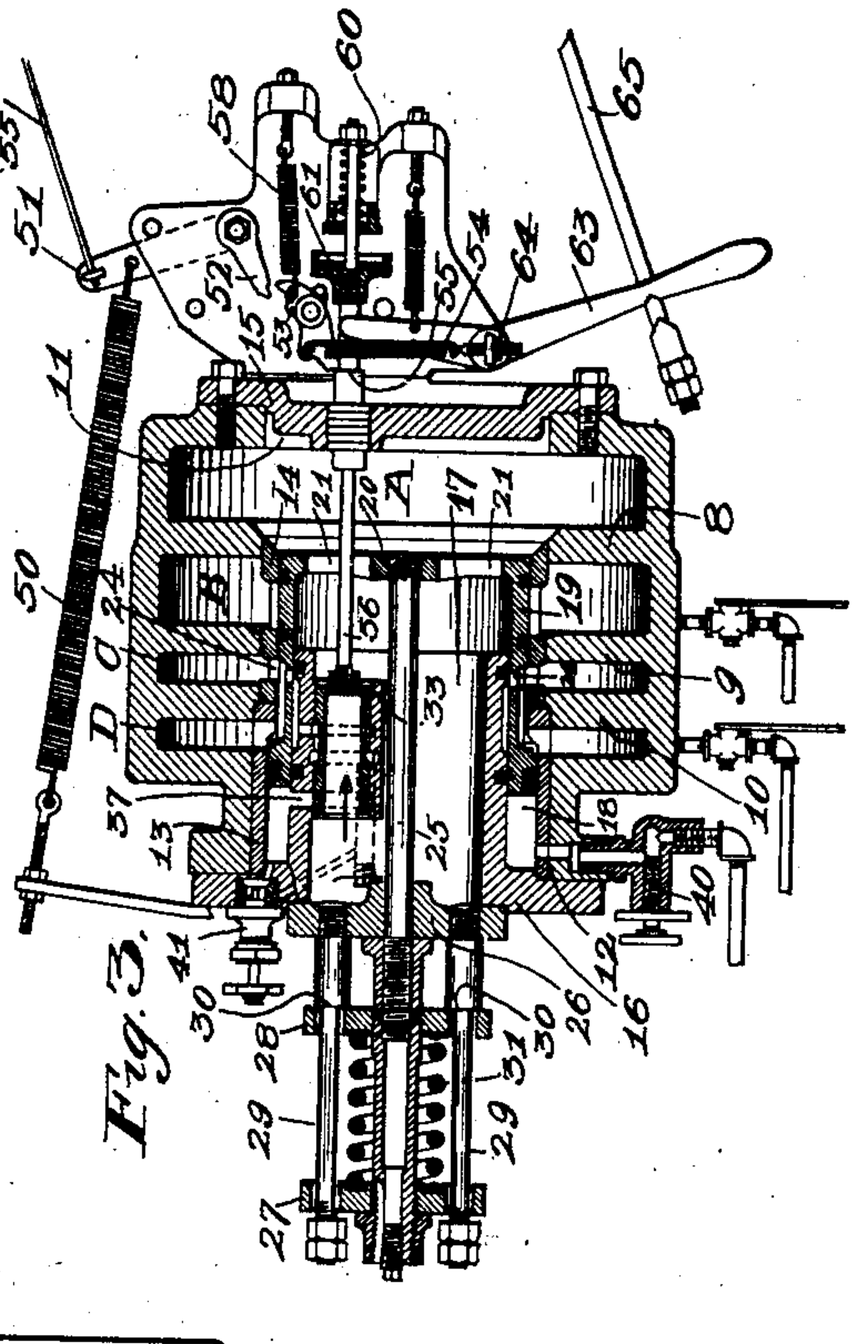

Fig. 3.

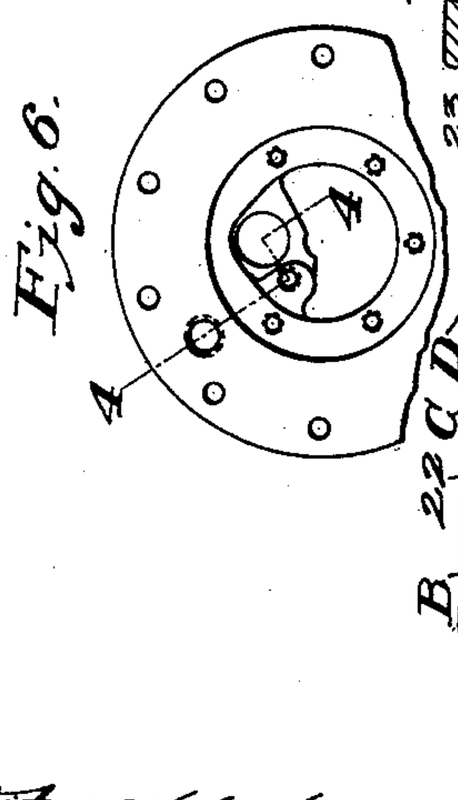

Fig. 6.

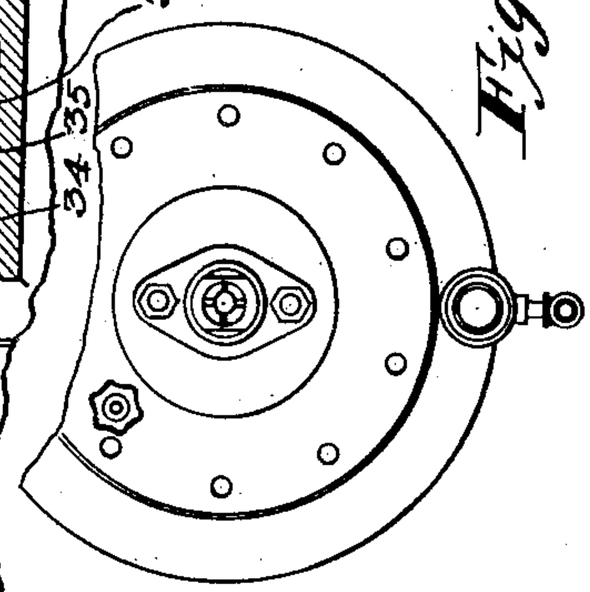

Fig. 7.

Witnesses
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No. 762,683. Patented June 14, 1904.

UNITED STATES PATENT OFFICE.

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VALVE.

SPECIFICATION forming part of Letters Patent No. 762,683, dated June 14, 1904.

Application filed July 8, 1902. Serial No. 114,781. (No model.)

To all whom it may concern:

Be it known that I, ELBERT H. CARROLL, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in Shear-Valves, of which the following is a specification, accompanied by drawings, forming a part of the same, in which—

Figure 1 is a view showing a side of a steam-shear for cutting billets, showing the application of my improved valve thereto. Fig. 2 is an enlarged sectional view of the cylinder and valve-body. Fig. 3 is a vertical section through the valve-body and valves, on an enlarged scale, on the line 3 3 of Fig. 2. Figs. 4 and 5 are broken sectional views on the same line 4 4 of Fig. 6 on a much larger scale. Fig. 6 is an end view looking into the flanged ring, forming a portion of the valve-body; and Fig. 7 is an inner end view of the valve-body. Fig. 8 is an enlarged detailed view of the trip, and Fig. 9 is a detached view of the gage for releasing the trip.

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

An object is to keep the distance for steam travel between valves at a minimum; also, to maintain a minimum volume of steam in the connecting-ports.

The object of my present invention is to accomplish the quick opening of the exhaust-port of the so-called "steam flying shears" to cause the piston to respond instantly to the full expansive force of the head of live steam upon the piston, whereby to impart the required power to the shears necessary to sever the billet.

A further object is to so construct and incase the valve mechanism that all parts thereof are kept hot and at a substantially uniform temperature.

With these objects in view my invention consists in certain novel features of construction and combination of parts which will be hereinafter described, and pointed out in the claims.

Referring to the accompanying drawings, the cylinder 1 is stationed upon the machine-bed 2 in any approved manner and is shown on Fig. 1 at about an angle of forty-five degrees. The piston 2 is fitted within the cylinder and provided with stem 3 at one end, and with the outer end the cross-head 4 is secured.

The numeral 5 indicates the live-steam supply-pipe, and through this a continual head of steam is supplied to the outer or upper end of the cylinder through port 6. The valve-body 7 is conveniently secured to one side of the cylinder, as shown in Fig. 1. This valve-body may be variously constructed, but, as shown, has a general cylindrical form externally. Internally it is provided with several annular flanges 8, 9, and 10, which divide the valve-body into four chambers A, B, C, and D, respectively, in the order named, beginning at the outer or upper end. The inner edges of these flanges are in approximate alinement with one another and also in alinement with the openings 11 and 12, formed, respectively, in the opposite ends of the valve-body. Fitted to these inner circular edges are two cylindrical bushings 13 and 14, which for convenience of construction are of slightly-different diameter and in the assemblage of parts necessitating their being inserted from opposite ends of the valve-body through openings 11 and 12, respectively. The bushings are turned to true cylinders inside and are provided with openings *b*, *c*, and *d* into the chambers B, C, and D, respectively. The opening 11 at the outer or upper end of the valve-body is closed by a head 15 and the opposite or lower end by a gland 16, this being bolted or otherwise secured in place, and the gland 16 is provided with a cylindrical hub 17, which has a carefully-turned outer surface of somewhat less diameter than that of the inner surfaces of the bushings 13 and 14, with which surfaces it is concentric, so that an annular valve-chamber 18 is formed between said hollow annular hub 17 and the bushings 13 and 14. In this annular chamber the main valve 19 is fitted, it being hollow and cylindrical and of

a length somewhat greater than the width of the three chambers B, C, and D. This main valve is entirely open at its lower end and has a head 20 at its upper end provided with orifices 21 21 therein. Valve 19 carries suitable packings 22 to make it steam-tight on its outer surface, and the annular hub 17 may also have packings 22 to make the valve run steam-tight. The valve also has an annular recess 23, formed circumferentially about its surface, and a port 24 is made from this recess through the valve. Stem 25 extends from the center of the main valve through the head 26 at the lower end of the valve-body, and on it the cross-plates 27 and 28 are mounted, the former of which is secured thereto and both of which are loosely mounted and capable of sliding upon guide-rods 29 29. These guide-rods have shoulders 30 30, against which the inner loose plate 28 is held by a spiral spring 31, the object of which construction is to form a yielding buffer for the main valve when it reaches its extreme stroke in either direction.

Within the hollow bore of the hub 17 of gland 16 there is an enlargement in the metal which is counterbored to form a cylindrical opening 32, and fitted to this and adapted to slide endwise therein is the hollow cylindrical pilot-valve 33, which is closed at its upper end and open at its lower end and in communication with the interior of the hub 17 and chamber A of the valve-body. This pilot-valve 33 is reduced circumferentially, as at 34, whereby to form an annular recess, and this is adapted to bridge the two live-steam ports 35 and 36 when steam is being admitted into the lower end of the cylinder to force the piston suddenly upward, as is illustrated in Figs. 3 and 4 of the drawings, to force the piston to the position illustrated in Fig. 2, the live steam being permitted by this position and the pilot-valve to follow the course indicated by the arrow in Fig. 4 to impinge against the lower end of the main valve to force the latter into the position indicated in Figs. 3 and 4, so that steam may pass from a pipe 5′ from the upper end of the cylinder, and thence through opening *d*, recess 24 in the outer wall of the main valve 19, through opening *c* into chamber C, which is in communication with and supplies the lower end of the cylinder with steam. From the lower end of chamber 18 an exhaust-port 37 leads into the bore 32, in which the pilot-valve 33 slides, and out through this port 37 the steam exhausts when the pilot-valve is moved outward in the direction indicated by the arrow, and when the pilot-valve is in the position shown in Fig. 5 the exhaust from the lower end of the cylinder escaping from chamber B through the opening *b*, which has been opened by the movement of the main valve, as shown in Fig. 5, thence into chamber A, and out through the discharge-orifice 38. (See Fig. 2) Of course it is understood that there is a constant pressure of steam at opposite ends of the recessed portion 23 in the outer wall of the main valve; but the area of the inner or lower end is greater than the area of the opposite end, so that the valve will in that way be moved inward. This is what causes the inward movement of the main valve when exhaust-port 37 is opened. The area of the inner or lower end of main valve is still larger, and hence when live steam enters chamber 18 the valve is forced outward or upward, due to the greater area exposed to the force of the steam. The valve will be moved inward with a sudden impulse until port 37 is covered and the remaining steam in chamber 18 is compressed sufficiently to balance the pressure in recess 24. The stroke of main valve 19, after passing over port 37, is controlled by exhausting the compressed steam from chamber 18 through a needle-valve 40, which can readily be adjusted, as it is obvious that the speed of main piston 2 is entirely controlled by the stroke of main valve 19. To regulate the rapidity with which steam is to enter chamber 18 from the lower end of the main valve, a needle-valve 41 is employed, it being set to the position necessary to admit the required amount of steam and at the speed desired. This valve is under the control of mechanism which will now be described. The usual gage 45 is pivoted in the path of the moving billet a predetermined distance from the shears 46 46, so that when the billet reaches the gage it is to be severed, and it is the purpose of my valve mechanism to automatically cause the shears to act. The gage is therefore swung upon its support 47, where it is pivoted against the tension of a spring 48, which causes it to slacken the tension of 49, which previously has been held taut by spring 48. This action permits spring 50, which is weaker than spring 48, to swing the arm 51, with which it is connected, downward, causing the finger 52 thereon to strike the outer end of trip 53, which latter normally is held by spring 54 against a shoulder 55 on the stem 56 of the pilot-valve. The trip is preferably jointed, as at 57, to allow the finger 52 to sweep past its upper end should the finger ever drop to a position below it, the spring 58 being provided to retain this pivoted section in a position against the lug 59. This release of the valve-stem permits a stiff spiral spring 60 on the outer end of valve-stem 56 to force the pilot-valve upward or outward, a cushioning device 61 causing it to stop in its outward throw. As has been explained, this is the initial action of the valve mechanism preparatory to the downward movement of the piston 2 in the operation of the shears. Crosshead 4, connected with the upper end of piston 2, is connected to the shears in the usual manner by a pair of links 62 62. To cause the

return or resetting of the pilot-valve to the position indicated in Figs. 3 and 4 of the drawings, an arm 63 is provided, it being fulcrumed at 64 and divided at its upper end, as at 65, to straddle the valve-stem 56. This lever 63 is swung inwardly at its upper end by means of a rod 65, and this rod 65 is connected with a crank 66, capable of being set at different positions on the dial 67, holes 68 68 being provided for this purpose. Dial 67 is secured on a rock-shaft 69, carried in the bracket 70. On the inner end of shaft 69 an arm 71 is secured, and this arm is connected by a link 72 to the arm 73, carried by the cross-head 4.

The operation may be briefly explained as follows: When the billet has reached the desired position to be cut, it strikes the gage 45, rocking it out of its normal position. This causes the trip 53 to release the pilot-valve, as explained, spring 60 operating to throw the pilot-valve outward or upward. This opens the port 37 in chamber 18 and permits the steam to exhaust therefrom into chamber A. Valve 19, descending, uncovers opening *b*, allowing the exhaust-steam in the lower end of the cylinder 1 to escape, and the piston 2, upon the upper end of which a full head of steam is being supplied, to rapidly descend, and by so doing cause the shears to cut. The descent of the piston causes the rod 65 to raise the arm 63 and force the rod 56 back again to its normal position, the trip automatically engaging shoulder 55 and locking the pilot-valve in its inner position, as shown in Figs. 3 and 4, which movement of the pilot-valve establishes communication through ports 35 and 36 and the lower end of chamber 18, letting steam into the latter to force the main valve 19 upward to the position shown in Figs. 3 and 4, which closes exhaust-port leading into chamber A and allows live steam to pass from pipe 51 into chamber D, thence through opening *d* into the circumferential recess 23 into the outer wall of main valve 19, thence out through the opening *c* in the bushing into chamber C, and from that chamber into the lower end of the cylinder to raise the piston.

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

1. The combination with a cylinder, provided with inlet and exhaust steam ports and a valve-body to which the ports lead, the valve-body provided with an exhaust-opening, of valve mechanism located within the valve-body, the valve mechanism comprising a plurality of hollow shells, one within the other, the interiors of the shells in constant communication with the exhaust-opening.

2. The combination with a cylinder, piston, live and exhaust steam ports, and a valve-body, of valve mechanism located within the valve-body, said mechanism hollow with the interior always open to the exhaust-passage from the valve, and a portion always exposed to the head of live steam, substantially as described.

3. The combination with a cylinder, provided with inlet and exhaust ports and a piston, of a valve-body with which the inlet and exhaust ports of the cylinder communicate, the valve-body provided with an exhaust-opening, a valve mechanism located within the valve-body, the valve mechanism comprising a plurality of valves one within the other and out of engagement with one another, the outer valve being wholly steam-actuated and the inner valve wholly mechanically actuated.

4. The combination with a cylinder provided with a piston, of a valve-body secured thereto, the cylinder provided with an inlet-port for a continual head of motive power and having ports communicating with the valve-body, the valve-body provided with an exhaust-opening, a hollow shell received within the valve-body and constituting the main valve, and a pilot-valve received within but out of contact with the main valve, each valve being in constant and uninterrupted communication with the exhaust-opening.

5. The combination with a cylinder, piston, live and exhaust steam ports, and a valve-body, of valve mechanism therein comprising two valves, one within the other, and an annular hub or wall to which the outer valve is fitted and within which the inner valve is located, said hub or wall having ports therein, each valve having a circumferential recess, and the outer valve having a port therethrough adapted to communicate with a port in the hub or wall, substantially as described.

6. The combination with a cylinder, piston, and live and exhaust steam ports in the valve-body, of valve mechanism comprising a concentric hub and two cylindrical valves, one fitted to the annular chamber outside of the concentric hub, and the other in a bore formed in the hub, ports in the valves, and hub, and cushioning means for the valve mechanism, substantially as described.

7. The combination with a cylinder, piston, and live and exhaust steam ports in the valve-body, of valve mechanism comprising a concentric hub and two cylindrical valves, one fitted to the annular chamber outside of the concentric hub, and the other in a bore formed in the hub, ports in the valves and hub, and cushioning means for the valve mechanism, and adjustable means for regulating the amount of live steam discharged into the annular chamber, substantially as described.

8. The combination with a valve-body having chambers therein, bushings fitted to the inner edges of the walls or partitions between the chambers from opposite ends thereof, and a gland partly closing one end of the valve-body and provided with an annular hub concentric with the bushings and having openings therethrough, of a valve operating in the annular chamber between the hub and the

bushing, and provided with a suitable port, and a pilot-valve operating in a bore formed in an enlargement in the hub to control the ports formed therein, substantially as described.

9. The combination with a valve-body having chambers therein, bushings fitted to the inner edges of the walls or partitions between the chambers, and a gland partly closing one end of the valve-body and provided with an annular hub concentric with the bushings and having openings therethrough, of a valve operating in the annular chamber between the hub and the bushing, and provided with a suitable port, and a pilot-valve operating in a bore formed in an enlargement in the hub to control the ports formed therein, said valves both having their interiors in open communication with the exhaust-passage of the valve-body, substantially as described.

10. The combination with a valve-body having chambers therein, bushings fitted to the inner edges of the walls or partitions between the chambers, and a gland partly closing one end of the valve-body and provided with an annular hub concentric with the bushings and having openings therethrough, of a valve operating in the annular chamber between the hub and the bushing, and provided with a suitable port, and a pilot-valve operating in a bore formed in an enlargement in the hub to control the ports formed therein, the pilot-valve spring-actuated, substantially as described.

11. The combination with a cylinder provided with an inlet-port and a piston, of a valve-body, a passage leading from the cylinder to the valve-body, and a return-passage leading from the valve-body to that end of the cylinder opposite the inlet-port, the valve-body provided with an exhaust-opening, the cylinder provided with an exhaust-port leading into the valve-body, a main valve located in the valve-body and controlling the exhaust-port from the cylinder, and a mechanically-operated pilot-valve controlling the movement of the main valve.

12. The combination with a cylinder provided with an inlet-port and a piston, of a valve-body, a direct passage connecting one end of the cylinder to the valve-body, and a return-passage connecting the valve-body with the opposite end of the cylinder, the valve-body provided with an exhaust-opening, a main valve located in the valve-body and provided with a recessed exterior adapted to connect the direct passage with the return-passage, the main valve also adapted to permit communication between the exhaust-port of the cylinder and the exhaust-opening of the valve-body alternately with the connection of the direct and return passages and a mechanically-actuated pilot-valve out of engagement with the main valve and controlling its movements.

13. The combination with a cylinder having an inlet-port and a piston, a valve-body and direct and return passages extending between the cylinder and valve-body, of flanges formed interiorly of the valve-body and dividing it into a plurality of compartments, one of the compartments in direct communication with an exhaust-opening, a main valve located within the valve-body, the main valve adapted to close all but the exhaust-compartment, the direct passage communicating with one of the compartments closed by the valve, the return-passage communicating with an adjacent compartment, a third compartment connected to the cylinder by means of an exhaust-passage therefrom and mechanically-operated means for controlling the main valve to cause the communication between the direct and return passages and to open the exhaust-compartment alternately.

14. The combination with a cylinder and a valve-body connected by direct and return passages and an exhaust-passage extending from the cylinder to the valve-body, of a series of compartments formed in the valve-body, the direct return and exhaust passages connecting with the separate chambers, a main valve controlling communication between the direct and return passages, the valve provided with a port adapted to connect the two chambers with which the direct and return passages connect, a chamber within which the main valve operates, a communicating passage leading from the valve-port to the valve-chamber at one end thereof, and mechanically-operated means for controlling the communicating passage.

15. The combination with a cylinder, of a tubular valve-body, a gland closing one end of the valve-body, a head closing the other end thereof, the cylinder and valve-body communicating by means of direct and return passages and an exhaust-passage, the gland provided with a hub provided with a bore and ports extending between the exterior of the hub and the bore, a main valve operating in the chamber between the interior of the valve-body and the hub, the main valve adapted to connect the direct and return passages and open the exhaust-passage, a pilot-valve located in the bore of the hub and controlling the ports therein and a means of communication between the direct passage and the ports in the hub through the main valve, the valve-body provided with an exhaust-opening with which the exhaust-passage is adapted to communicate.

16. The combination with a cylinder, of a valve-body communicating with the cylinder by means of a direct passage, a return-passage and an exhaust-passage, a main valve located in the valve-body and controlling the communication between the direct and return passages, and the opening and closing of the exhaust-passage, a valve-stem secured to the

main valve and projecting outside the valve-body, cross-plates located on the stem, a spring located intermediate the cross-plates, guide-rods upon which the cross-plates loosely rest and shoulders on the guide-rods for limiting the movement of the cross-plates in each direction.

17. The combination with a cylinder, of a valve-body communicating with the cylinder by means of a direct passage, a return-passage and an exhaust-passage, a main valve located in the valve-body and controlling the communication between the direct and return passages, and the opening and closing of the exhaust-passage, and mechanical means for cushioning the main valve.

Dated this 1st day of July, 1902.

ELBERT H. CARROLL.

Witnesses:
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