D. R. WARD.

UPSETTING MACHINE.

APPLICATION FILED OCT. 13, 1908.

959,184.

Patented May 24, 1910.

4 SHEETS—SHEET 1.

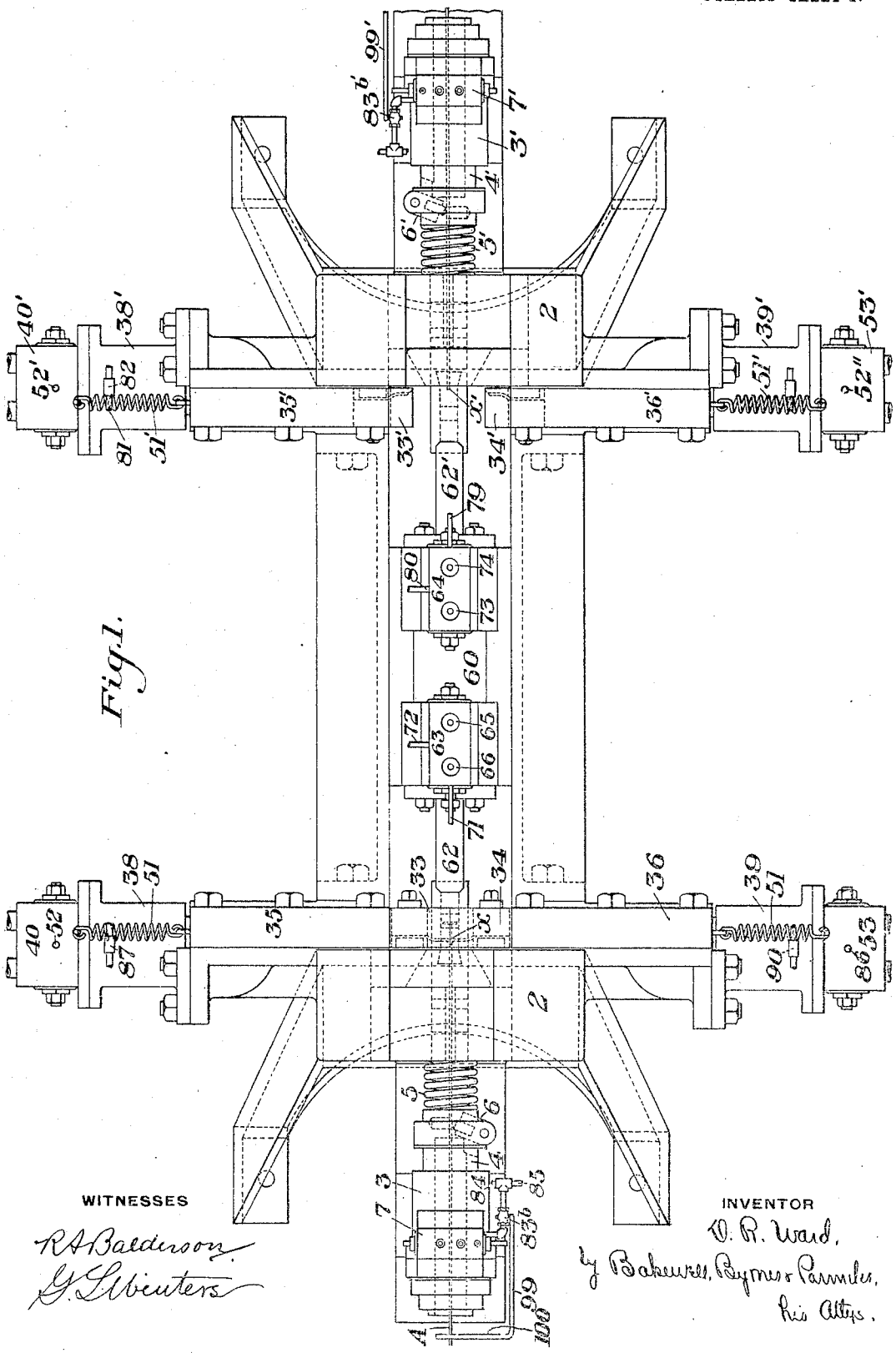

Fig. 1.

WITNESSES

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4 SHEETS—SHEET 2.

Fig. 2.

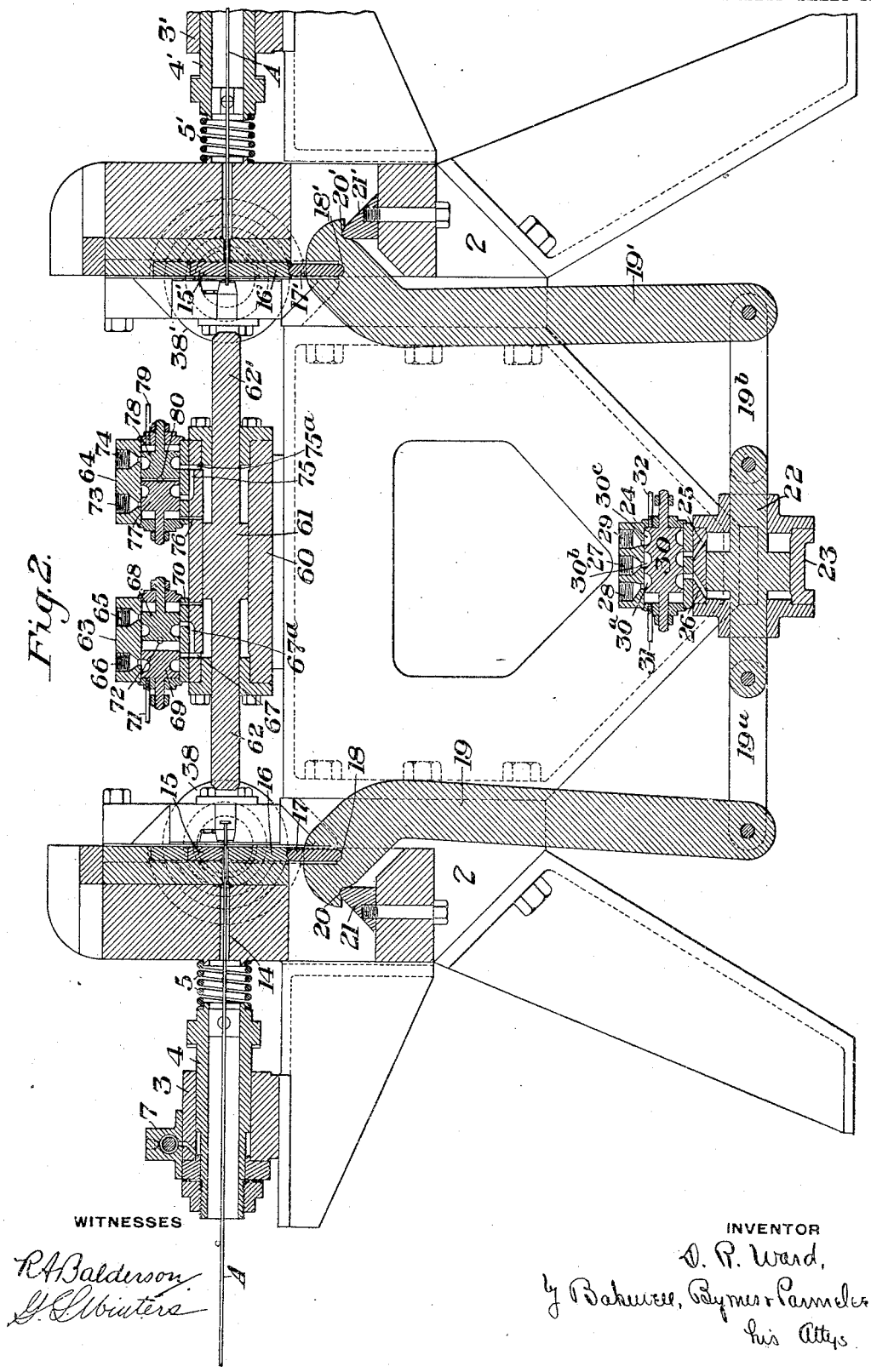

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Fig. 4.

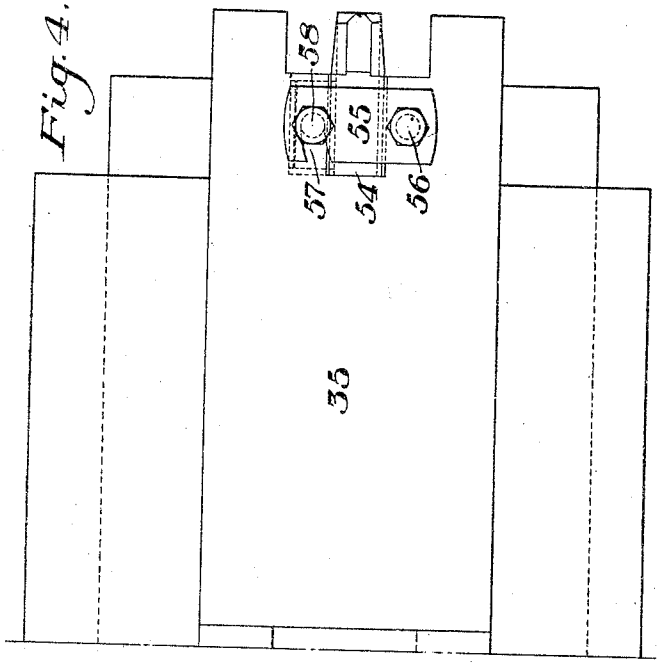


Fig. 3.

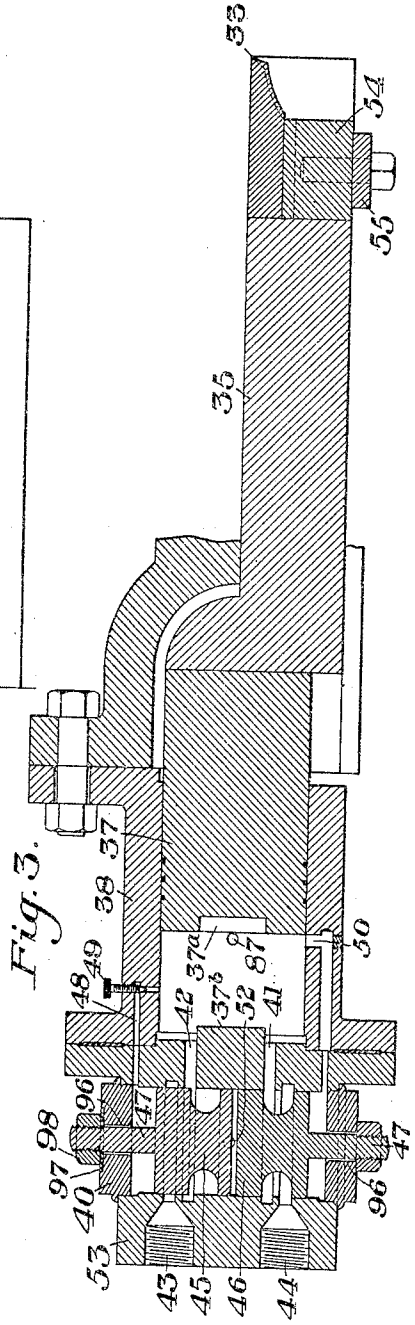


Fig. 6.

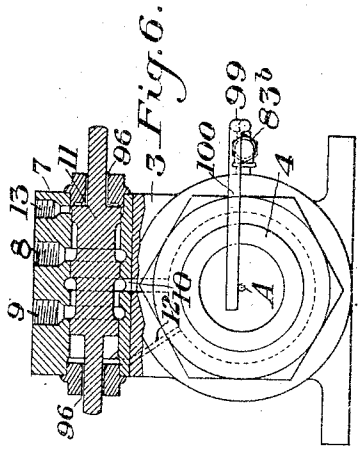
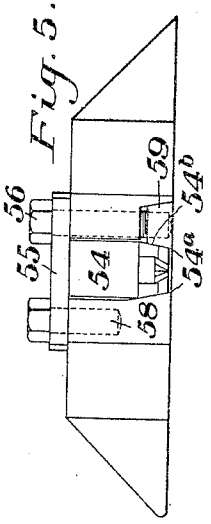


Fig. 5.



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4 SHEETS—SHEET 4.

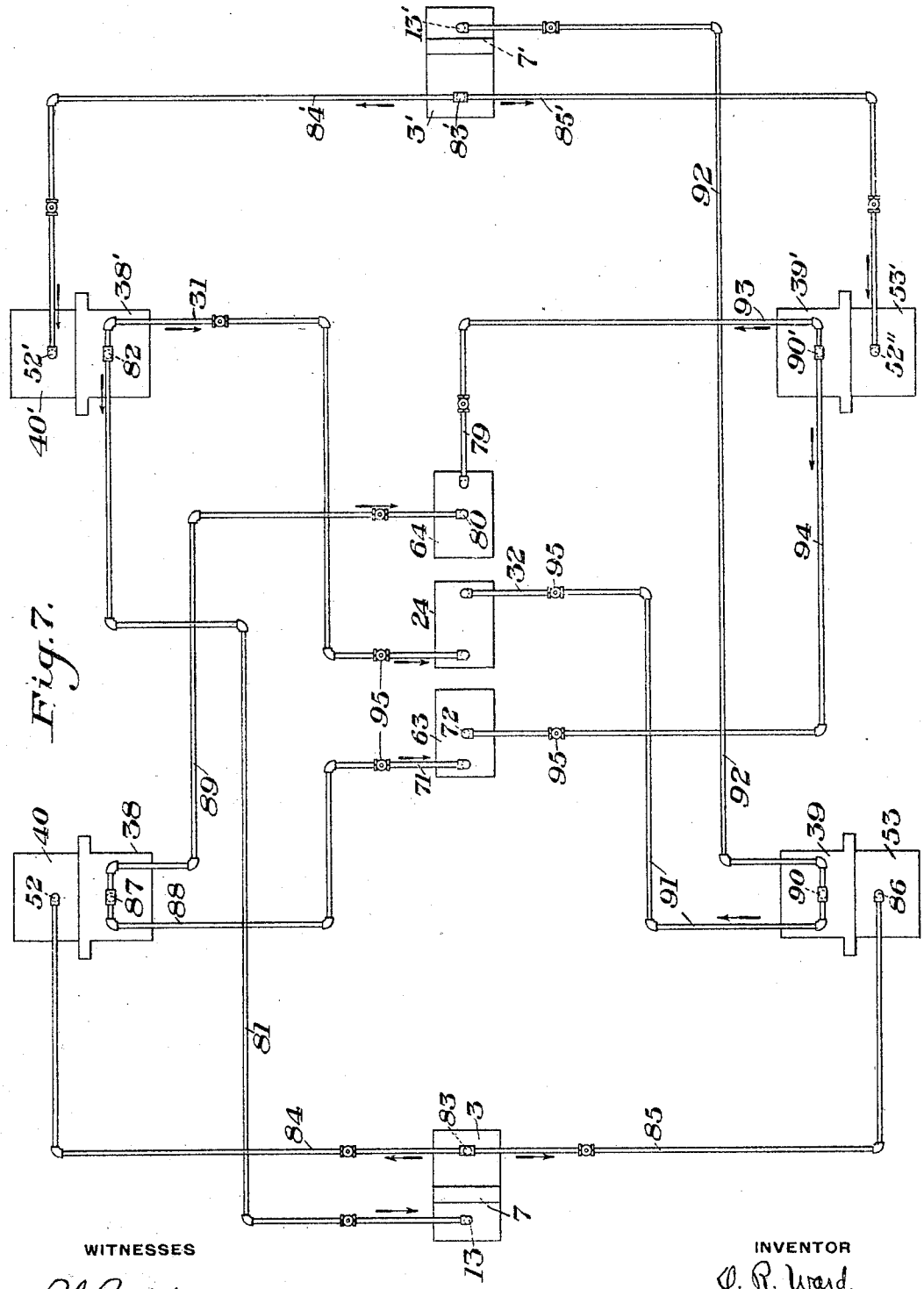

Fig. 7.

WITNESSES

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UNITED STATES PATENT OFFICE.

DAVID R. WARD, OF STRUTHERS, OHIO.

UPSETTING-MACHINE.

959,184. Specification of Letters Patent. Patented May 24, 1910.

Application filed October 13, 1908. Serial No. 457,468.

To all whom it may concern:

Be it known that I, DAVID R. WARD, of Struthers, Mahoning county, Ohio, have invented a new and useful Upsetting-Machine, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan view of one form of machine embodying my invention, with the pipe connections removed; Fig. 2 is a vertical longitudinal sectional elevation of the same; Fig. 3 is a horizontal longitudinal section through one of the cutting-off cylinders, its cutting-off slide and die; Figs. 4 and 5 are respectively front and end elevations of the cutting-off slide and die; Fig. 6 is a view partly in section, and partly in elevation, showing one of the feed-in cylinders and its controlling valves; and Fig. 7 is a diagrammatic view illustrating the connections for operating the valves of the different cylinders.

My invention has relation to upsetting machines for the manufacture of nails, spikes, tacks, rivets, bolts, and other headed articles, and is designed to provide a simple and effective machine of this character, in which the heading or upsetting operation, and preferably also the other operations necessary to the formation of the article, are carried out by means of power cylinders, thereby avoiding the necessity of heavy moving parts, such as are commonly employed in machines of this character.

Further objects and advantages of my invention will hereinafter appear.

The nature of the invention will be best understood by reference to the accompanying drawings, in which I have shown one embodiment thereof, and which will now be described, it being understood, however, that various changes may be made in the details of construction and arrangement of the parts by those skilled in the art without departing from the spirit and scope as defined in the appended claims.

The machine shown in these drawings is a double form of machine, the wire or other stock in which the articles are to be formed being fed in from both ends of the machine, the feeding mechanism at one end operating to advance the stock, while the upsetting is being effected at the other end of the machine, and vice versa. At each end the stock is first fed into the machine, and is then gripped and securely held to the action of the heading or upsetting tool; the headed stock is then released and advanced to the action of the cutting-off mechanism a sufficient length to form the articles, these operations being repeated in succession.

In the drawings, the numeral 2 designates the frame of the machine at opposite end portions of which are mounted the feed-in cylinders 3, 3′. Inasmuch as the feed-in mechanism, the gripping or pinching mechanism, and the cutting-off mechanism at the two ends of the machine are practically duplicates, that at one end only will be described in detail, and the corresponding reference characters will be applied to similar parts at the other end with the addition of prime marks thereto. The cylinder 3 is a single-acting cylinder carrying a plunger 4, which is actuated by the pressure within the cylinder to advance the stock, and which is moved in the opposite direction by a spring such as indicated at 5. The plunger 4 carries a feeding dog 6, which is arranged to grip the wire during the forward or feeding stroke of the plunger, but to slide freely on the wire during the reverse or backward movement of the plunger. The cylinder 3 is provided with a valve case 7 (shown in detail in Fig. 6), having the inlet port 8 and the exhaust port 9, and communicating with the interior of the cylinder by a central combined inlet and exhaust port 10. These three ports are controlled by a single valve 11 of double piston type. In the position shown in Fig. 6, the valve connects the port 10 with the exhaust port 9; but when moved to the left to its other position, the exhaust port 9 is closed and the port 10 is connected with the admission port 8. At or about the time the plunger 4 completes its forward or feeding stroke, it uncovers a port 12 leading through the cylinder wall into one end of the valve casing and admits pressure through said port to move the valve 11 to the position shown in Fig. 6, thereby cutting off the inlet and opening the exhaust port 9. The valve is moved to its other position by admitting pressure to the port 13 in the manner hereinafter described.

A designates the wire or other stock being fed into this end of the machine, and which passes through the plunger 4, through the guide opening 14 and between the pinch or gripping dies 15 and 16. The upper

gripping die 15 is a fixed die, while the lower die 16 is movable toward and away from the die 15. The die 16 is supported on a block or member 17, having a rocking seat at 18 in the upper end of a vertical lever 19. This lever has its fulcrum at 20 upon the nose of a fulcrum block 21. The levers 19 and 19′ at the two ends of the machine are respectively connected by links 19^a and 19^b with opposite ends of a piston 22 working in the cylinder 23 at the lower portion of the machine. Mounted on this cylinder is a valve casing 24, which communicates with opposite ends of the cylinder by the respective ports 25 and 26. The valve casing 24 is also provided with a central inlet port 27 and two exhaust ports 28 and 29. Within this valve casing is a piston valve 30 having three circumferential ports or passages 30^a, 30^b and 30^c. In the position of the valve shown in Fig. 2, the inlet port 27 is connected by the port 30^b with the port 25, and the port 26 is connected with the exhaust port 28 by the port 30^a. The port 29 is closed. In the other position of the valve, the pressure will be admitted from the port 27 to the opposite end of the cylinder through the port 26, and the port 25 will be put into exhaust communication with the port 29. The valve is shifted from one position to the other by means of pressure admitted at the ends of the valve casing through the pipes 31 and 32, whose connections are hereinafter described. With the parts in the position shown in Fig. 2, the plunger 22 has been moved to the left, thereby rocking the lever 19 on the fulcrum point 20 to release the grip of the die 16 and at the same time to actuate the lever 19′ to cause the die 16′ to tightly grip the advance end of the stock to hold it to the action of the heading tool.

33 and 34 designate the cutting-off dies at one end of the machine, 33′ and 34′ being the corresponding dies at the opposite end of the machine. The two dies of each pair are both movable laterally toward and away from the longitudinal center of the machine, being carried by the respective slides 35 and 36. The slide 35 is attached to a plunger 37, working in a single-acting cylinder 38 (see Fig. 3), while the slide 36 is connected to the plunger of a corresponding cylinder 39 located at the opposite side of the machine. The cylinder 38 is provided with a valve casing 40 communicating with the interior of the cylinder by two ports 41 and 42, and having each an inlet or supply port 43 and an exhaust port 44. In this valve casing are two oppositely working piston valves 45 and 46, each of which is guided by the stem 47 projecting outwardly through the head of the valve casing. In the position of these valves shown in Fig. 3, the inlet port 42 has been cut off from the supply port 43, and the exhaust port 41 has been put in communication with the exhaust port 44. In the other position of the two valves, the ports 41 and 44 are closed with respect to each other, and ports 42 and 43 are opened with respect to each other. The valve 45 is moved to the position shown in Fig. 3 by pressure admitted through a port 48, which communicates with the interior of the cylinder at an intermediate point in the stroke of the piston or plunger 37. When the mouth of the port 48 is opened, pressure is admitted behind the valve 45 to close the port 42, and the balance of the stroke of the piston or plunger 37 is effected by expansion. Inasmuch as it may be desired, however, to vary somewhat the point of cut-off, I preferably provide the port 48 with a needle controlling valve 49, which may be set so as to require a shorter or longer time for the pressure to build up sufficiently behind the valve 45 to move it to its cut-off position. The valve 46 is moved to the position shown in Fig. 3 by pressure admitted from the cylinder 38 through the port 50, the mouth of this port 50 being uncovered at the end of the forward stroke of the piston or plunger 37, as shown in Fig. 3. The piston or plunger 37 and the slide 35 are given their reverse movement to retract the cutting-off die by spring means such as indicated at 51. The valves 45 and 46 are moved to their other positions by pressure admitted intermediate of the same through the port 52 in the manner hereinafter described.

The end of the piston or plunger 37 is shown as having a pocket 37^a therein, and the rear cylinder head has a corresponding projection 37^b, the purpose of these parts being to provide for the cushioning of the piston or plunger upon its reverse or backward stroke, by the compression of the air in the pocket 37^a.

The cylinder 39 is provided with an arrangement of valves, which is the duplicate in all respects of that for the cylinder 38, and the two slides 35 and 36 always operate in unison. The valve casing for the cylinder 39 is indicated at 53 (see Fig. 1). The point of cut-off with reference to the face of the pinch dies is indicated at x and x' at the two ends of the machine; and for the purpose of providing for the adjustment of this point of cut-off in order to provide for the formation of heads or up-sets of different sizes, the cut-off dies 33 and 34, and 33′ and 34′ are made adjustable in the manner shown in Figs. 3, 4 and 5. That is to say, each die is seated against an adjustable block 54, which is secured in place by a strap 55 pivoted on the bolt 56 and having a slot 57 in its opposite end which engages a bolt or stud 58. The dies have beveled sides in the manner indicated in Fig. 5, these

beveled sides being indicated at 54ª and fitting correspondingly beveled sides 54ᵇ of the die gib 59. It will be seen that by using blocks 54 of different thicknesses, or by placing one or more liners between the same and the dies, the point of cut-off can be readily changed, so as to leave a shorter or longer length of metal for the up-set projecting beyond the face of the pinch dies which act as anvils for the action of the upsetting tool.

59 designates a beveled key or gib, which secures the die-blocks against lateral movement, as best shown in Fig. 5.

The heading or upsetting means consists of a power cylinder 60, which is arranged at the upper central portion of the machine with its axis in line with the lines of feed of the wire or other stock. This cylinder is a double-acting cylinder, and has therein a plunger 61 with extensions 62 and 62′, projecting through the respective heads of the cylinder and forming the upsetting hammers. Connected to the cylinder 60 are the two valve casings or chests 63 and 64. The valve casing 63 is provided with a supply port 65 and with an exhaust port 66, and an inlet port 67ª and exhaust port 67 communicating with one end of the cylinder 60. In this valve casing or chest are the two piston valves 68 and 69, the valve 68 being the inlet controlling valve for the port 67ª, and the valve 69 the controlling valve for the exhaust port 67. These two valves are similar in arrangement to the valves 45 and 46 of the cylinder 38, but are operated in a somewhat different manner. In the position shown in Fig. 2, the valve 68 has been moved to close the inlet to the cylinder, while the valve 69 is still closing the exhaust. The valve 68 has been moved to the position shown by pressure admitted from the corresponding end of the cylinder 60 through a port 70, which is uncovered by the piston 61 at that point in its stroke, the balance of the stroke of the piston to the right being effected by expansion. The valve 69 is moved to its other position by pressure admitted behind the same through a pipe 71 in the manner hereinafter described. The valve 68 is moved to its other position, and the valve 69 is moved to the position in which it is shown in Fig. 2, by pressure admitted through the port 72 in the manner hereinafter described.

The valve casing 64 connected to the opposite end of the cylinder 60 has the inlet port 73 and the exhaust port 74, which correspond respectively to the ports 65 and 66. It also has the cylinder inlet port 75 and cylinder exhaust port 75ª, corresponding respectively to the ports 67ª and 67, and the cut-off port 76 corresponding to the cut-off port 70. This casing also has the two valves 77 and 78 which correspond respectively to the valves 68 and 69. In the position of the valves 77 and 78 shown in Fig. 2 the cylinder exhaust port 75ª is open and the cylinder inlet port 75 is closed. The valve 77 has been moved to the position shown in this figure during the last reverse stroke of the piston 61 by pressure admitted through the port 76, and the valve 78 has been moved to the position shown in this figure by pressure admitted through the pipe 79 in the manner hereinafter described. The two valves are moved to their other positions by pressure admitted through a port 80 communicating with a space intermediate the two valves in the manner also hereinafter described.

The port 13 of the valve casing 7 of the cylinder 3 is connected by a pipe 81, (see Fig. 7) with the exhaust port 82 of the cut-off cylinder 38′ at the opposite end of the machine, this exhaust port 82 being arranged to be uncovered at the end of the stroke of the piston of that cylinder. This port 82 is also connected by the pipe 31 before referred to as leading into one end of the valve casing 24. The cylinder 3 is also provided with a port 83, which is arranged to be uncovered at the end of the stroke of the piston 4, and this port 83 is connected by a pipe 84, with the port 52 of the valve case 40 before described, and also by a pipe 85 with a corresponding port 86 of the valve casing 53 of the cylinder 39. The cylinder 38 has a port 87, which is arranged to be uncovered by the piston 37 at the end of its stroke, and which is connected by a pipe 88 with the pipe 71 before referred to as communicating with one end of the valve casing 63. The port 87 is also connected by a pipe 89 with the port 80 leading into the central portion of the valve casing 64. The cylinder 39 has a port 90 corresponding to the port 87 of the cylinder 38 and connected by a pipe 91 with the pipe 32 leading into one end of the valve casing 24. The port 90 is also connected by a pipe 92, with a port 13′ of the valve casing 7′ corresponding to the port 13 of the valve casing 7. The cylinder 3′ has a port 83′ corresponding to the port 83, and connected by the pipe 84′ with a port 52′ of the valve casing 40′ corresponding to the port 52 of the valve casing 40. The port 83′ is also connected by a pipe 85′ with the port 52″ of the valve casing 53′ corresponding to the port 86 of the valve casing 53. The cylinder 39′ has an exhaust port 90′, corresponding to the exhaust port 90 and connected by a pipe 93 with the pipe 79 before referred to as leading into one end of the valve casing 64. The port 90′ is also connected by pipe 94, with the port 72 leading into the central portion of the valve casing 63.

The operation is as follows:—Power being admitted to the cylinder 3 through the inlet port 8, connected with any suitable

source, the plunger 4 is first moved to the right to feed in a length of stock equal to the length of one of the articles to be formed together with a sufficient length in addition to form the head. As the plunger 4 completes its stroke, the port 83 of the cylinder 3 is uncovered, thereby admitting pressure to the pipes 84 and 85. This actuates the valves of the cylinders 38 and 39 to admit pressure to said cylinders, and thereby actuate their plungers to cause the cut-off slides and dies to advance to effect the cutting off of the previously formed article which has been moved in a position to be cut off by the feed-in movement just described. When the pistons of the cylinders 38 and 39 complete their stroke they uncover the ports 87 and 90, thereby simultaneously admitting pressure to the four pipes 88, 89, 91, 92. The pressure admitted to the pipes 88 and 89 effects the operation of the valves in the valve casing 63 and 64 to admit pressure to the right-hand end of the cylinder 60 and open the exhaust at the left-hand end, thereby actuating the plunger 61 to cause the hammer 62 to operate. At the same time the admission of pressure to the pipe 91 actuates the valve in the valve casing 24 to admit pressure to the left-hand end of the cylinder 23, and thereby actuate its plunger 22 to effect the gripping operation of the gripping dies 15 and 16 and to release the gripping action of the pinch dies 15′ and 16′ at the opposite end of the machine. The admission of pressure to the pipe 92 admits air through the port 13′ of the valve casing 7′ to actuate its valve to admit pressure to the cylinder 3′ and thereby effect a feed-in operation at this end of the machine. As soon as the plunger of this cylinder 3′ completes its forward movement, it uncovers the port 83′ and admits pressure to the pipes 84′ and 85′ to thereby actuate the controlling valves of the cylinders 38′ and 39′. This actuates the cutting-off slides and dies at this end of the machine to cut off the finished article formed by the preceding operation of the hammer 62′. When the pistons or plungers in the cylinders 38′ and 39′ open the ports 82 and 90′ pressure is simultaneously admitted to the pipes 81, 31, 93 and 94. The admission of pressure to the pipes 93 and 94 reverses the action of the valves in the casing 63 and 64 to effect the reverse operation of the plunger 61, and cause the hammer 62′ to make its upsetting stroke. The admission of pressure to the pipe 31 reverses the action of the valve which controls the cylinder 23, and thereby actuates the levers 19 and 19′ to set the pinch dies 15′ and 16′ and to release the pinch dies 15 and 16. The admission of pressure to the pipe 81 sets the valve 11 in position to admit pressure to the cylinder 3 and effect another feed-in operation at this end of the machine. This cycle of operations is repeated indefinitely so long as the machine is in operation, the exhaust from one operation being used to move the valve or valves of the cylinder or cylinders which effects the next operation or operations.

Each of the several pipe connections shown in the diagram of Fig. 7 is preferably provided with a control valve 95, so that any one of said pipes may be independently closed to prevent the subsequent operation controlled thereby, this being useful for instance, in setting and adjusting the machine, in which it may be desired to effect the operation of one part of the machine without going through the entire cycle of operations.

The exhaust for the several valve chambers may be effected by providing sufficient clearance around the valve stems as indicated at 96 in Figs. 3 and 6. Inasmuch, however, as it is desirable that there should be no escape of air through the clearance spaces around the stems of valves 45, 68 and 77 while in the positions to which they are moved by the admission of pressure to the adjacent ends of their respective chambers, the stems of these valves will preferably be provided, as shown in Fig. 3, with a washer 97, which will be held by the nut 98 on the end of the valve stem in position to prevent the escape of air through the clearance space 96 until such time as the valve is to be moved to its other position by the admission of pressure against its opposite end. As soon as the valve is so moved, the washer 97 is released to permit the exhaust of the air. It is also desirable to provide the machine with means for stopping its operations when the ends of the wires or stock being fed in is reached. For this purpose I have shown the outlet pipes 83 and 83′ of each of the cylinders 3 and 3′ (to which outlet pipe or pipes 84, 85, or 84′ and 85′ are connected), as having a valve 83^b. Attached to the stem of this valve is a lever 99, having a transversely bent arm 100, which normally rests upon the wire or stock as it is fed into the plunger 4. As soon as the end of the wire or stock passes from underneath this lever, it falls by gravity and thereby closes the valve 83^b and stops the further operation of the machine, since it closes the pipes 84 and 85, (or the pipes 84′ and 85′), which control the operation of the cut-off cylinders and thereby the subsequent operations.

The advantages of my invention result from the provision of power cylinders for effecting the several operations of the machine, thereby doing away with crank and pitmen movements, or the movements of other heavy parts such as are commonly employed in this class of machines; and in accordance with my invention, the upsetting or heading hammers will always be actuated by a cylinder of this character. It is obvious, however, that either the pinching dies, the

cutting-off dies and the feed-in mechanism may be operated by other means if desired, although I prefer to use power cylinders in each case. By the provision of the valve means and controlling connections therefor, such as described, the entire cycle of operations may be carried on for an indefinite period without manual interference or control. I do not, however, limit myself to the particular valve mechanism and system of connections which I have herein shown and described, as it will be obvious that these may be varied in many respects and the same result obtained. The construction and arrangement of other details of the machine can also obviously be varied without affecting the invention.

While I have shown my invention as applied to a double form of machine, and prefer to so use it, it will be obvious that the invention is not restricted thereto, but may be employed in a single machine. I prefer to employ compressed air as a motive fluid for the several cylinders, but may use steam.

What I claim is:—

1. In a machine of the character described, the combination with a feed-in cylinder, a piston or plunger working therein, feed-in mechanism operated by the piston or plunger, a second cylinder, a heading tool carried by the plunger, of cut-off mechanism, power cylinders for actuating the cut-off mechanism, and valve means and connections for utilizing the exhaust from the feed-in cylinder for controlling the operation of the cut-off cylinders; substantially as described.

2. In a machine of the character described, the combination with cutting-off dies, and power cylinders for actuating the same, of a heading or upsetting tool, a power cylinder for controlling the operation of such tool, and valve means and connections for utilizing the exhaust from the cut-off actuating cylinders to control the operation of the power cylinder which operates the heading tool; substantially as described.

3. In a machine of the character described, the combination with cutting-off dies and power cylinders for effecting the operation of the same, of gripping means for holding the stock to the action of the heading tool, a heading tool, a power cylinder for actuating the heading tool, and valve means and connections controlled by the cut-off die actuating cylinders for controlling the operation of the cylinders which actuate the holding means and the heading tool; substantially as described.

4. In a machine of the character described, feed-in mechanisms located at opposite ends of the machine, gripping and cutting off mechanisms in connection with each feed-in mechanism, and a double acting heading cylinder arranged intermediately of the two sets of feed-in, cut-off and holding mechanisms, a piston or plunger in said cylinder, and two oppositely operating heading tools actuated by said piston or plunger together with actuating connections between the mechanisms at opposite ends of the machine, and means in connection therewith whereby the operations at one end of the machine are in part timed and controlled by the operations at the opposite end of the machine; substantially as described.

5. In a machine of the character described, the combination of two feeding mechanisms located at opposite ends of the machine, two sets of cut-off and gripping mechanisms, one set of each such mechanisms operating in connection with one of the feed-in mechanisms, a double-acting power cylinder arranged intermediately of the two sets of mechanisms, a piston or plunger working in said cylinder, two oppositely acting heading tools carried by the piston or plunger, and valve means or connections whereby the operation of the cut-off mechanisms controls the admission and exhaust valves of the said cylinder together with actuating connections between the mechanisms at opposite ends of the machine, and means in connection therewith whereby the operations at one end of the machine are in part timed and controlled by the operations at the opposite end of the machine; substantially as described.

6. In a machine of the character described, the combination of two feeding mechanisms located at opposite ends of the machine, two sets of cut-off and gripping mechanisms, one set of each such mechanisms operating in connection with one of the feed-in mechanisms, a double-acting power cylinder arranged intermediately of the two sets of mechanisms, a piston or plunger working in said cylinder, two oppositely acting heading tools carried by the piston or plunger, valve means or connections whereby the operation of the cut-off mechanisms controls the admission and exhaust valves of the said cylinder, together with other valve means and connections whereby the cut-off mechanisms control the operations of the holding mechanisms together with actuating connections between the mechanisms at opposite ends of the machine, and means in connection therewith whereby the operations at one end of the machine are in part timed and controlled by the operations at the opposite end of the machine; substantially as described.

7. In a machine of the character described, the combination of feed-in mechanism, a power cylinder for actuating the feed-in mechanism, cut-off tools, a power cylinder for actuating the cut-off tools, a heading tool, a power cylinder for actuating the heading tool, and valve means and connec-

tions whereby the exhaust from the feed-in cylinders controls the operation of the cut-off cylinders, and other valve means and connections whereby the exhaust from the cut-off cylinders controls the heading tool cylinder; substantially as described.

8. In a machine of the character described, the combination of two sets of feed-in mechanisms, located at opposite ends of the machine and in line with each other, power cylinders for operating said mechanisms, cut-off tools and stock-holding means operating in connection with each feed-in mechanisms, a heading cylinder arranged intermediate of the two cut-off mechanisms, and in line therewith, a piston working in said cylinder and having oppositely projecting heading tools, valve means and connections whereby the operation of the feed-in mechanisms controls the operation of the cut-off mechanisms, other valve means and connections whereby the operation of the cut-off mechanisms controls the operation of the stock-holding mechanisms, and other valve means and connections whereby the action of the cut-off mechanism at one end controls the action of the feed-in mechanism at the opposite end of the machine; substantially as described.

9. In a machine of the character described, the combination of two sets of feed-in mechanisms and two power cylinders actuating the same, a cut-off mechanism operating in connection with each of the feed-in mechanisms, power cylinders for controlling the cut-off mechanisms, and valve means and connections whereby the feed-in cylinders at one end control the operation of the cut-off cylinders at the same end and whereby the cut-off cylinders at that end of the machine control the feed-in mechanism for the opposite end of the machine; substantially as described.

10. In a machine of the character described, the combination of two sets of feed-in mechanisms and two power cylinders actuating the same, a cut-off mechanism operating in connection with each of the feed-in mechanisms, power cylinders for controlling the cut-off mechanisms, and valve means and connections whereby the feed-in cylinders at one end control the operation of the cut-off cylinders at the same end and whereby the cut-off cylinders at that end of the machine control the feed-in mechanism for the opposite end of the machine, together with oppositely acting heading tools, a power cylinder for actuating the heading tools, and connections operated by the cut-off cylinders for controlling the operation of the heading tool cylinder; substantially as described.

11. In a machine of the character described, the combination of two sets of feed-in mechanisms and two power cylinders actuating the same, a cut-off mechanism operating in connection with each of the feed-in mechanisms, power cylinders for controlling the cut-off mechanisms, valve means and connections whereby the feed-in cylinders at one end control the operation of the cut-off cylinders at the same end and whereby the cut-off cylinders at that end of the machine control the feed-in mechanism for the opposite end of the machine, holding mechanisms, operating in connection with each of the cut-off mechanisms, a power cylinder for operating the holding mechanisms, and valve connections whereby the exhaust from the cut-off cylinders is utilized to control the operation of the holding mechanism cylinder; substantially as described.

12. In a machine of the character described, the combination with feed-in mechanisms located at opposite ends of the machine, of two pairs of stock-holding dies, one pair of said dies operating in connection with each of the feeding mechanisms, each of said pairs of dies having one fixed member and one movable member, levers supporting the movable members, a double-acting power cylinder, a piston or plunger in said cylinder, and connections on opposite sides of said piston or plunger to the respective levers; substantially as described.

13. In a machine of the character described, a cut-off slide, means for actuating said slide, a block adjustably held in said slide, and a cut-off die also seated in the slide and against said block, said block by its adjustment forming means to vary the point of cut-off of said die; substantially as described.

14. In a machine of the class described, a cut-off tool, a power cylinder for actuating the said tool, a plunger or piston therein frictionally connected to the cut-off tool, a valve to control the action of the plunger or piston, and adjustable means to control the relation between the position of the plunger or piston in its forward movement and the time of closing of the valve to thereby vary the blow of the cut-off tool; substantially as described.

15. In a heading machine, the combination with means for feeding in the stock, and holding dies through which the stock is fed, of a power cylinder having its axis substantially in line with the axis of the aperture in the dies, a plunger or piston in the cylinder, and a heading tool operated by the cylinder and the plunger or piston, and arranged to strike a direct blow against the piece to be headed; substantially as described.

16. In a machine of the character described, the combination with feeding mechanism, holding mechanism and cutting-off mechanism, and power cylinders for actuating each of said mechanisms, of a heading or upsetting tool, a power cylinder for con-

trolling the operation of such tool, and valve means and connections whereby the time of operation of each of said mechanisms and tool is controlled by the time of exhaust from the power cylinder effecting the operation of another of the mechanisms; substantially as described.

17. In a machine of the character described, the combination of feeding mechanisms, cutting-off mechanisms, power cylinders for actuating said mechanisms, a heading or upsetting tool, a power cylinder for controlling the operation of such tool, and valve means and connections for utilizing the exhaust from the operation of one of said cylinders for controlling the time of operation of another cylinder; substantially as described.

18. In a machine of the character described, the combination of feeding mechanism, cutting mechanism and holding mechanism, of an impact power cylinder, a plunger or piston working therein, and an impact heading tool carried by the plunger or piston, together with valve means to control the action of the cylinder, and operating connections for the other mechanisms whereby the operations of the heading cylinder and of the other mechanisms are correlated; substantially as described.

19. In a machine of the character described, the combination of cutting mechanism, holding mechanism and heading mechanism, of a power cylinder, a piston or plunger working therein, feed-in mechanism carried by the piston or plunger, together with valve means to control the action of the cylinder and operating connections for the other mechanisms whereby the operation of the feeding cylinder and of the other mechanisms are correlated; substantially as described.

20. In a machine of the character described, the combination of feeding mechanism, holding mechanism, cutting mechanism and heading mechanism, of a power cylinder, a piston or plunger working therein and connected to operate the cutting mechanism, together with valve means to control the action of the cylinder and operating connections for the other mechanisms whereby the operations of the cutting-off cylinder and of the other mechanisms are correlated; substantially as described.

21. In a machine of the character described, the combination of feeding mechanism, holding mechanism, cutting mechanism and heading mechanisms, of a power cylinder, a piston or plunger working therein and connected to operate the holding mechanisms, together with valve means to control the action of the cylinder and operating connections for the other mechanisms whereby the operation of the holding cylinder and the other mechanisms are correlated; substantially as described.

22. In a heading machine, the combination with stock feeding and holding mechanisms, of a power cylinder, a piston or plunger therein, and a heading tool secured directly to the piston or plunger, and valve means for controlling the cylinder whereby its time of operation may be controlled with relation to the time of operation of the feeding and holding mechanisms; substantially as described.

23. In a heading machine, a supporting frame, feeding and holding mechanisms at opposite end portions of the frame, a power cylinder placed intermediate of said mechanisms, a piston or plunger in said cylinder, and a heading tool secured to each end of the piston or plunger, said tools having their axes in substantial alinement with the lines of feed of the feed mechanisms; substantially as described.

24. In a heading machine, a supporting frame, feeding and holding mechanisms at opposite end portions of the frame, a power cylinder placed intermediate of said mechanisms, a piston or plunger in said cylinder, and a heading tool secured to each end of the piston or plunger, said tools having their axes in substantial alinement with the lines of feed of the feed mechanisms, and controlling means for the cylinder and for the two feed and holding mechanisms, whereby said cylinder and mechanisms operate in time relation, and the mechanisms at opposite ends of the machine operate reversely; substantially as described.

In testimony whereof, I have hereunto set my hand.

DAVID R. WARD.

Witnesses:
J. H. C. Lyon,
Louis F. Baldwin.