Aug. 3, 1954 H. G. RATH 2,685,443

HOT BAR CUTTING MACHINE

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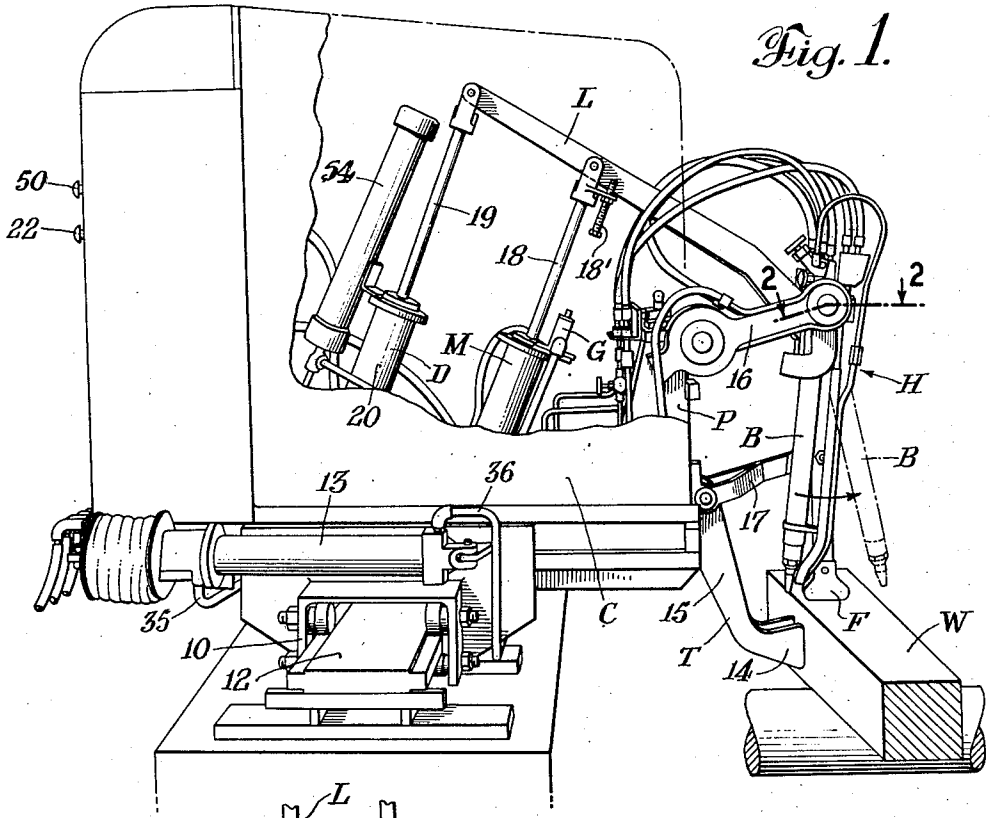
Fig. 1.



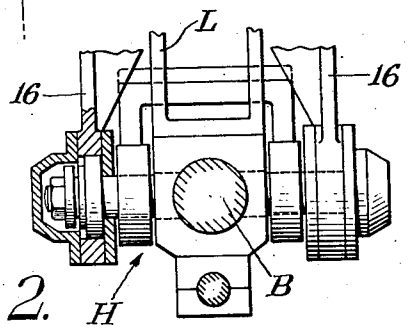


Fig. 2.

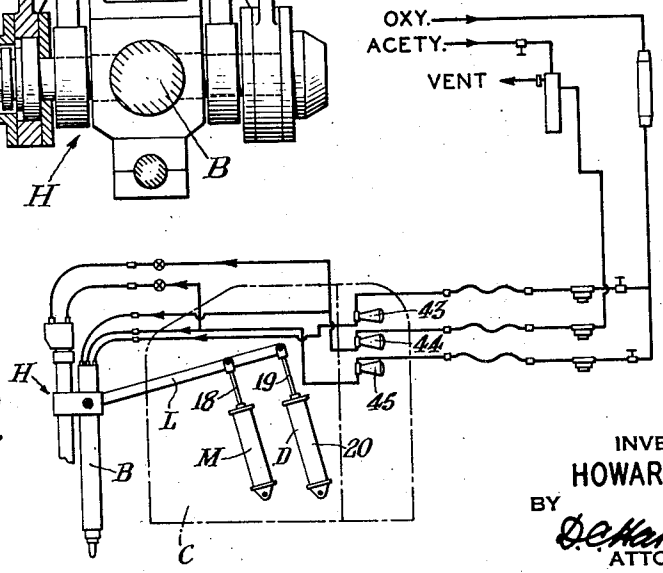


Fig. 3.

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Fig. 4.

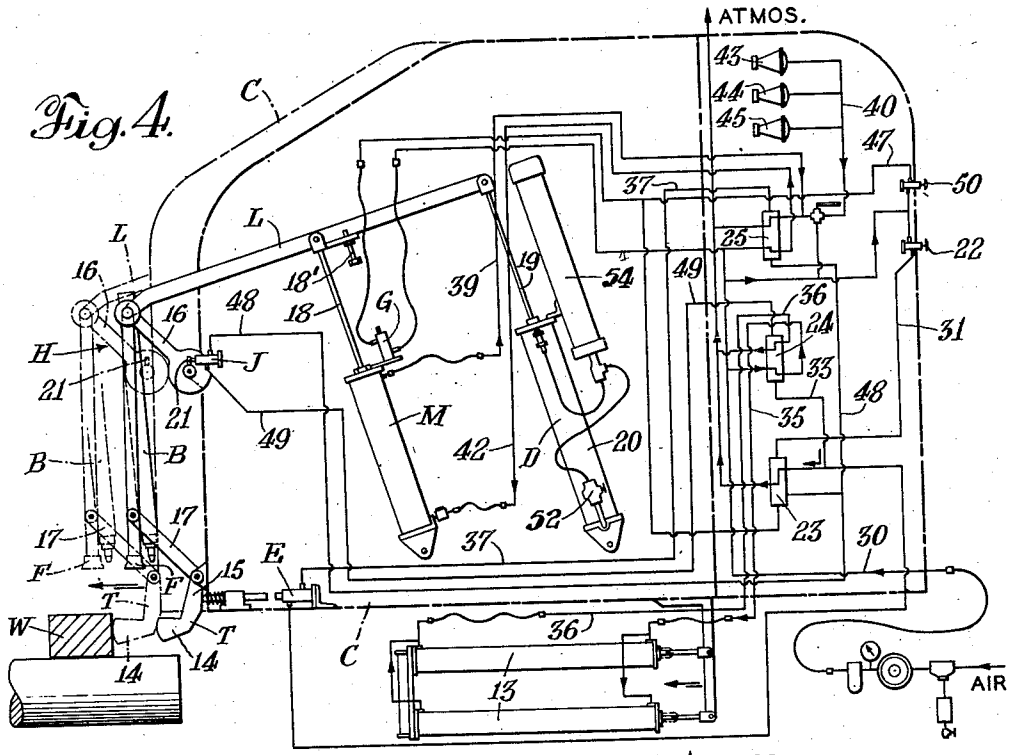

Fig. 5.

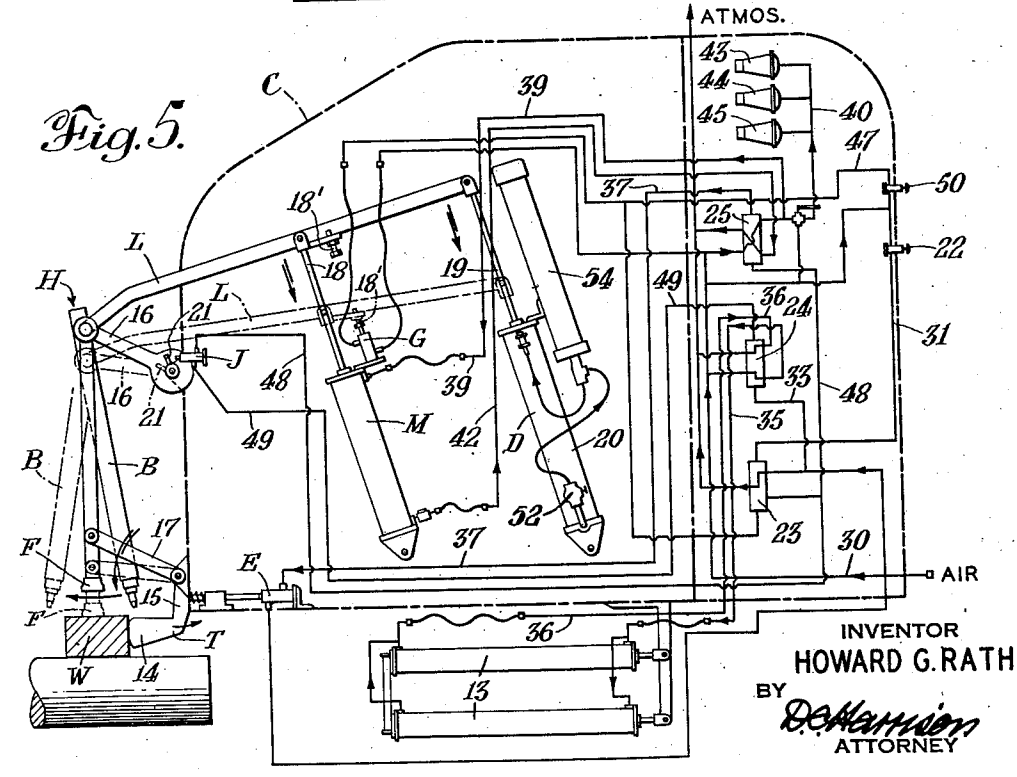

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Fig. 6.

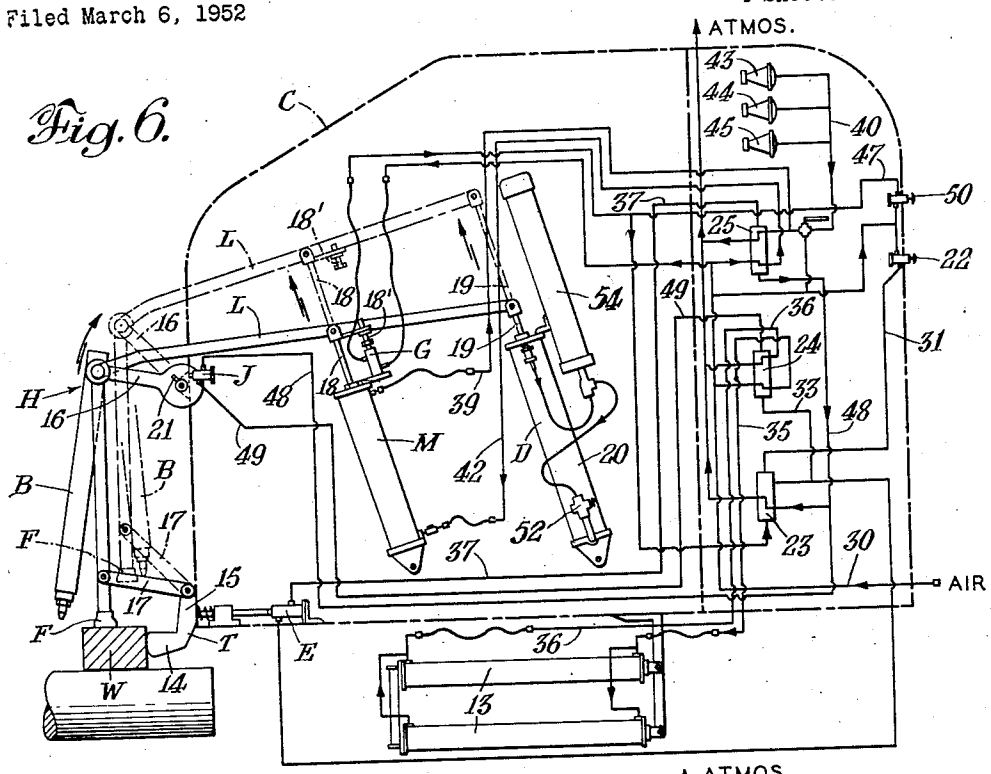

Fig. 7.

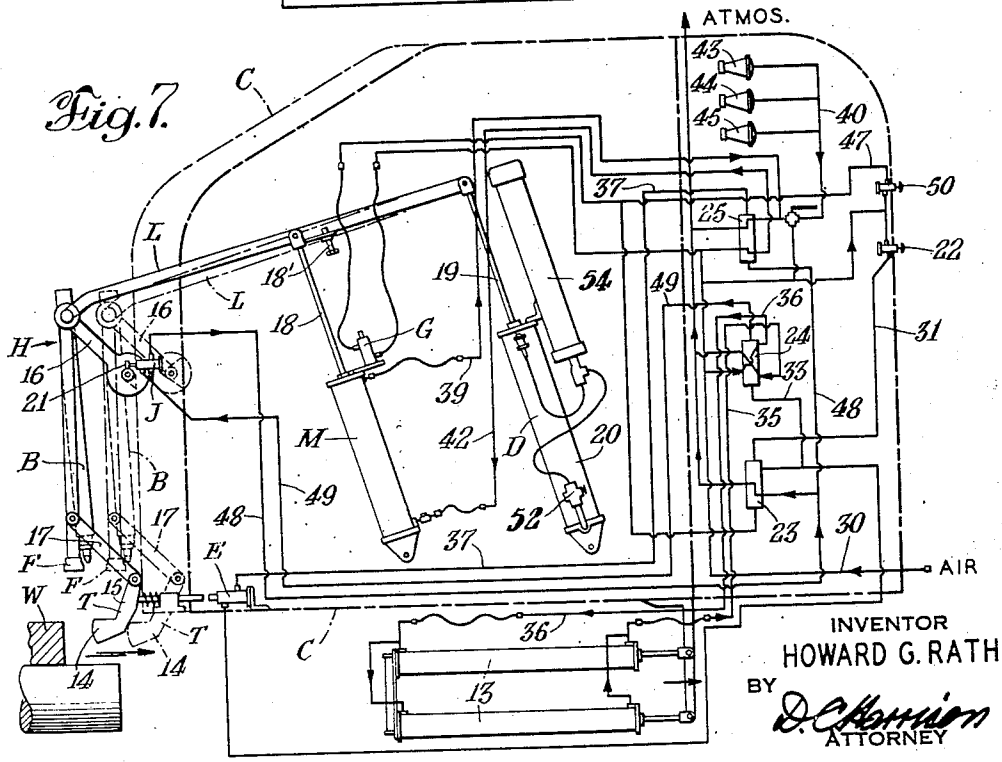

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Fig. 8.

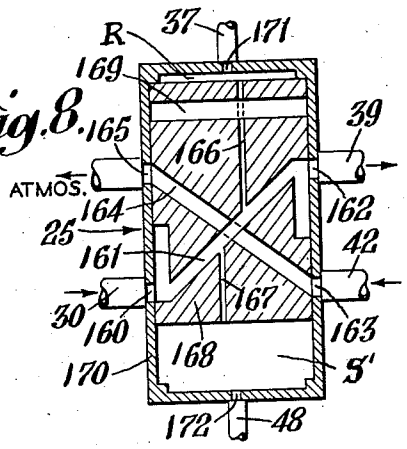


Fig. 9.

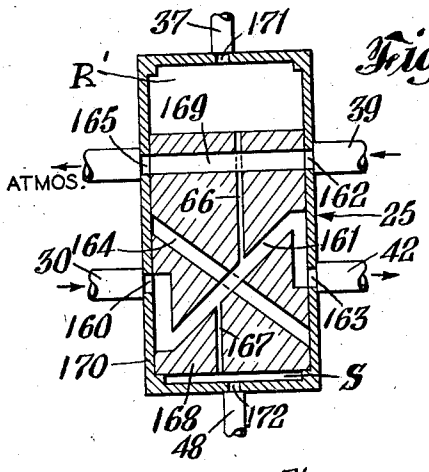


Fig. 10.

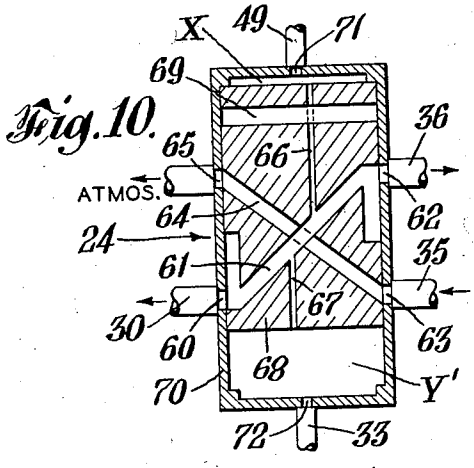


Fig. 11.

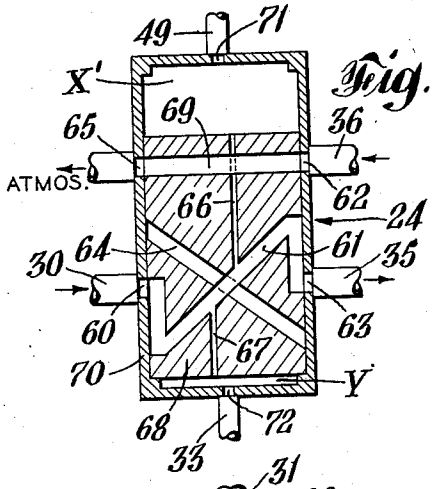


Fig. 12.

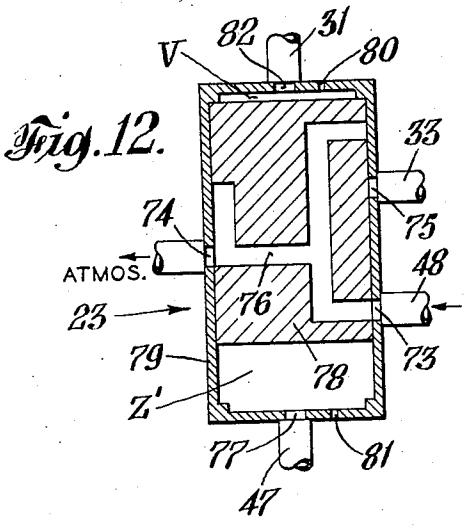
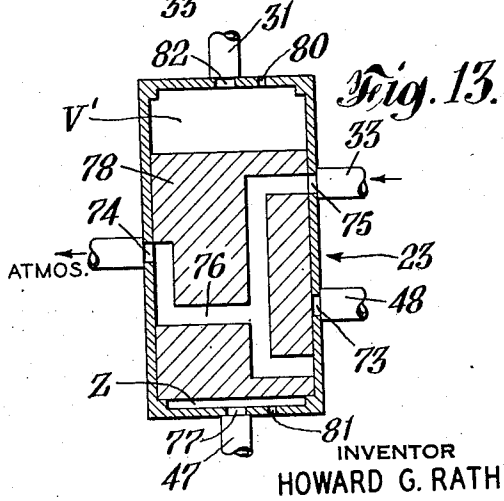


Fig. 13.



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2,685,443

UNITED STATES PATENT OFFICE

2,685,443

HOT BAR CUTTING MACHINE

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Application March 6, 1952, Serial No. 275,132

6 Claims. (Cl. 266—23)

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This invention relates to hot bar cutting machines for thermochemically severing elongated metal stock by means of an oxy-fuel blowpipe.

This application is a continuation-in-part of my copending application Serial No. 79,174, filed March 2, 1949, now abandoned.

One of the important uses of machines of this character is in steel mills, where space is at a premium, being taken up by other equipment essential to various operations. It is therefore a main object of the present invention to provide a bar cutting machine which can be installed in a relatively small space.

Other objects of this invention are to provide a machine of this character which is simpler in construction, lower in cost, in which the cutting cycle is fully automatic, and which can be operated by compressed air, eliminating the need for electric power lines.

Other objects and features of novelty will be apparent from the following description and the accompanying drawings, in which:

Fig. 1 is a perspective view of the machine according to the preferred embodiment of the present invention;

Fig. 2 is a section taken along line 2—2 of Fig. 1;

Fig. 3 is a diagrammatic view of the piping for supplying gases to the blowpipe;

Fig. 4 is a diagram of the position of the parts at the beginning of the lowering operation;

Fig. 5 is a similar diagram for the beginning of the cutting stroke;

Fig. 6 is a similar diagram for the end of the cutting stroke and beginning of the holder raising operation;

Fig. 7 is a similar diagram for the carriage return operation;

Fig. 8 is a diagram of the motor control valve in one position;

Fig. 9 is a diagram of the motor control valve in another position;

Fig. 10 is a diagram of the slide cylinder valve in one position;

Fig. 11 is a diagram of the slide cylinder valve in another position;

Fig. 12 is a diagram of the pilot valve in one position; and

Fig. 13 is a diagram of the pilot valve in another position.

The machine comprises a carriage C movable transversely to the work W, which carriage supports the operating mechanism. The carriage C has a trip T at its forward end, adapted to engage the side of the work W and actuate a control device E as shown in Fig. 5.

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The blowpipe mechanism comprises a support or pedestal P upstanding at the front end of the carriage C, which supports for downward movement a blowpipe holder H having at its lower end a locating foot F adapted to engage the top of the work W. A blowpipe B is pivoted on the holder H and has a crank arm L secured thereto. The holder H is lowered by a fluid motor M actuating the arm L.

The control device E turns on the cutting gases for the blowpipe mechanism, and simultaneously starts the fluid motor M for lowering the blowpipe holder H. After the locating foot F engages the top of the work the blowpipe swings about its pivot for the cutting stroke, the cutting speed being controlled by a dashpot D.

At the completion of the cut, a control device G is actuated, as shown in Fig. 6, for shutting off the cutting gases and reversing the fluid motor M to raise the blowpipe mechanism from the work. When the raising movement is complete, a carriage retraction valve J opens automatically, as shown in Fig. 4, causing the carriage C to be drawn back to its starting position, and the blowpipe to swing back to its starting position.

In the form shown, the transverse carriage C is mounted on a longitudinal carriage 10 movable along tracks 12 located parallel to the work W for aligning the machine with respect to the desired line of cut. The transverse carriage C is driven by a pair of slide cylinders 13 and the trip T comprises a locating shoe 14 carried by a lever 15 pivoted on the front end of the carriage C to actuate the control device E when the shoe 14 engages the side of the work W.

The blowpipe holder H is mounted on the support P by an upper link 16 and the lower link 17 respectively pivoted to the support and holder to provide substantially parallel vertical movement of the holder. The fluid motor M comprises a pneumatic cylinder having piston rod 18 pivoted to an intermediate portion of the crank arm L. The dashpot D comprises a cylinder having a piston rod 19 pivoted to the end of the crank arm L. For the holder lowering operation, the dashpot resists movement of its piston 19, so that the rod 18 of the fluid motor M pulls the crank arm L down about its pivot on the rod 19, for a rapid lowering movement.

When the holder foot F engages the top of the work W, the holder can be lowered no further. Continued pressure in the fluid motor M pulling down on the crank arm L overcomes the resistance of the dashpot D, and forces down the piston rod 18, thus swinging the blowpipe B about its pivot on the holder H. The pivot of the

blowpipe is so located with respect to the trip shoe 14 for the width of the stock, that the cut starts at a lagging angle to facilitate starting, and terminates with a leading angle, to prevent losing the cut as the cutting stream comes through the stock.

The dashpot D functions as a hold back agent. The cylinder 20 is filled with hydraulic fluid and the cutting speed of the machine is controlled by metering this fluid from the lower port of the cylinder through the adjustable speed control valve 52 back into the upper port. During the cutting stroke a volume of fluid equivalent to the volume of the piston rod introduced into the cylinder is forced upward into the attached accumulator 54 which contains a dome of air originally at atmospheric pressure. When the piston of this cylinder is forced upward by the fluid motor M during the retraction stroke, high speed retraction is obtained by means of a poppet in the control valve 52 which permits the fluid to flow back rapidly from the top of the cylinder to the bottom and at the same time the pressure dome and the piston suction withdraw the fluid which was forced into the accumulator during the cutting stroke.

For actuating the control device G at the completion of the cutting stroke, the rod 18 carries an adjustable screw 18' for adjusting the length of the cutting stroke. For actuating the slide retraction valve J at the top of the raising movement, the upper link 16 carries a trip lug 21. The machine is fully automatic, being started by a starting button 22 and actuated from the mechanically tripped valves E, G and J, through pneumatically operated valves, including pressure operated pilot valve 23, exhaust operated slide cylinder valve 24, and exhaust operated motor control valve 25.

The pneumatic control system comprises a line 30 connected to a source of high pressure air, and leading to the starting valve 22. A line 31 leads from the starting valve 22 to the remotely controlled pressure operated pilot valve 23, the structure of which is illustrated in its two positions as shown in Figs. 12 and 13.

The valve 23 comprises a body 79 having a port 82 connected to line 31 from the starting valve 22. Slidably mounted in the valve body 79 is a piston 78 which confines a space V, V' in communication with the port 82, and at the opposite end a space Z, Z' in communication through a port 77 with a line 47 which leads to a reset valve 50. The valve body 79 has a bleed hole 80 for the space V, V' and a bleed hole 81 for the space Z, Z'.

The piston 78 has a passage 76 at all times in communication with the atmosphere through a port 74 at one side of the valve body 79. The passage 76 is branched to selectively communicate with service port 73 and exhaust port 75 in the opposite side of the valve body 79. Service port 73 is connected by line 48 to slide retraction valve J, and exhaust port 75 is connected by line 33 to the two position, four-way exhaust operated remotely controlled slide cylinder valve 24, the structure of which is shown in Figs. 10 and 11.

The slide cylinder valve 24 comprises a valve body 70 having a port 72 connected to the line 33 from the pilot valve 23. Slidably mounted in the valve body 70 is a piston 68 which confines a space Y—Y' in communication with the port 72, and at the opposite end a space X—X' in communication through a port 71 with line 49 from the slide retraction valve J.

The piston 68 has an internal passage 61 always in communication with a port 69 in one side of the valve body 70, connected to the high pressure air supply line 30. The other end of this passage 61 communicates alternately with ports 62 and 63 in the opposite side of the valve body 70. The piston 68 has a bleeder passage 66 leading from the passage 61 to the space X, X' and another bleeder passage 67 leading from the passage 61 to the space Y—Y'.

Port 62 is connected by line 36 to one end of carriage slide cylinder 13, and port 63 is connected by line 35 to the opposite end of slide cylinder 13. The piston 68 has a separate internal passage 64 adapted in the position shown in Fig. 10, to establish communication between port 63 and a port 65 in the opposite side of the valve body 70 and leading to the atmosphere.

The exhaust operated motor control valve 25 shown in Figs. 8 and 9 is of the same construction as the valve 24 shown in Figs. 10 and 11 and comprises a valve body 170, in which is slidably mounted a piston 168 which confines a space R—R' in communication with a port 171, and at the opposite end a space S—S' in communication with a port 172.

The piston 168 has an internal passage 161 always in communication with a port 169 in one side of the valve body 170, connected to the high pressure air supply line 30. The other end of this passage 161 communicates alternately with ports 162 and 163 in the opposite side of the valve body 170. The piston 168 has a bleeder passage 166 leading from the passage 161 to the space R—R' and another bleeder passage 167 leading from the passage 161 to the space S—S'. The piston 163 has a separate internal passage 164 adapted in the position shown in Fig. 8, to establish communication between the port 163 and a port 165 in the opposite side of the valve body 170 and leading to the atmosphere. However in valve 25 the port 171 is connected to the line 37 which leads to the control device E, and the port 172 is connected to line 43 which leads to the slide retraction valve J. Also, the port 162 is connected to the line 39 leading to fluid motor M, and port 163 is connected to line 42 leading from the other end of fluid motor M.

In operation, the starting valve button 22 having been depressed, high pressure air is admitted from line 30 to line 31 and passes to the pilot valve 23 through port 82 to the space V as shown in Fig. 12 which illustrates the position of valve 23 at the completion of the previous cutting cycle and at the beginning of the next cutting cycle. This actuates the valve 23, moving the piston 78 from the position of Fig. 12 to that of Fig. 13, so that passage 76 vents line 33 to the atmosphere and port 73 is closed.

Line 33 leads to valve 24 shown in Fig. 10 and vents space Y' to atmosphere. At the opposite end of valve body 70, line 49 is at the same pressure as line 30 by virtue of bleeder passage 66 in valve 24 and bleeder passage 167 in valve 25 which is shown in Fig. 9 as it appears at the completion of the previous cutting cycle and at the beginning of the next cutting cycle. Bleeder passage 167 communicates with line 49 through the port 72, line 48 and the valve J which is open at the beginning of a cutting cycle. Hence this condition operates valve 24, moving its piston 68 from the position of Fig. 10 to that of Fig. 11, in which passage 61 admits high pressure air from line 30 to line 35 at the same time venting line 36 to the atmosphere.

The line 35 actuates the carriage slide cylinder 13, causing the transverse carriage C to move toward the stock until as shown in Fig. 5 the locating shoe contacts the side of the work. When the shoe 14 operates the control device E which is closed at the beginning of a cutting cycle, this opens the line 37 through the line 33 and pilot valve 23 to the atmosphere.

Line 37 leads to valve 25 as shown in Fig. 9 and vents space R' to the atmosphere. At the opposite end of the valve body 170, line 48 is at the same pressure as line 30 by virtue of bleeder passage 167 and piston passage 161, and because of interconnection through the valve J with line 49 which is at the same pressure as line 30 at this time. These conditions cause actuation of motor control valve 25, moving its piston 150 up from the position of Fig. 9 to that of Fig. 8, in which piston passage 161 admits pressure from line 30 into line 39 which leads to fluid motor M.

Pressure in the line 39 forces the fluid motor piston downwardly, and its piston rod 18 pulls the crank arm L down about its pivot on dashpot piston rod 19, swinging the blowpipe holder H about the pivot of links 16 and 17 on the support P, until the foot F engages the top of the work W. When this happens, valve J closes.

The actuation of motor control valve 25 as shown in Fig. 8 also admits pressure from line 30 into line 40 which branches off from line 39, and vents line 42 to the atmosphere. This causes gas valves 43, 44 and 45 to open, admitting oxygen and acetylene, to the blowpipe B. Continued pressure in the fluid motor M causes the crank arm L to swing the blowpipe B about its pivot on the holder H against the action of the dashpot D for the cutting stroke.

At the completion of the cutting stroke, the screw 18' actuates the boom raising valve G which admits pressure from the line 30 into the line 47. Since the pressure in line 31 has by this time been restored to atmospheric by virtue of bleed hole 80, this reverses the pilot valve 23 as shown in Fig. 12, opening line 48 to atmosphere and closing off line 33 at port 75.

Since line 37 in Fig. 8 is at the same pressure as line 39 by virtue of bleeder passage 166 and because its path to atmosphere has now been blocked by valve 23, venting line 48 causes motor control valve 25 to operate moving its piston to the position of Fig. 9 admitting pressure from line 30 into line 42 and opening lines 39 and 40 to the atmosphere. This closes gas valves 43, 44 and 45 shutting off the cutting gases, and also causes the blowpipe carrying links 16 and 17 to move the holder H up off of the work W, under the action of the blowpipe cylinder M.

When the links are fully raised, the trip lug 21 opens the slide retract valve J. This vents line 49 through line 48, and since line 33 is now at the same pressure as line 30 due to the bleeder passage 67, this reverses slide cylinder valve 24, admitting pressure from line 30 into line 36 and venting line 35 to the atmosphere. This causes the rods of slide cylinder 13 to move out full length, retracting the carriage C and completing the automatic cycle.

If at an intermediate point during the cycle it becomes necessary to retract the machine, this can be done by momentarily depressing the reset valve button 50. This passes high pressure air from line 30 to line 47, and since the line 31 will be at atmospheric pressure at all times except when the starting valve 22 is open, the pilot valve 23 will operate so as to open line 48 to the atmosphere and close off line 33. Venting line 48 causes blowpipe motor control valve 24 to operate as previously described so as to admit pressure from line 30 to line 42, and exhaust line 39 to atmosphere. This effects immediate vertical retraction and returns all parts to starting position.

I claim:

1. In a blowpipe machine for cutting elongated metal stock, a blowpipe holder having a stock engaging abutment at the lower end thereof and a blowpipe pivoted thereon near the upper end thereof, a support for said blowpipe holder, means for mounting said holder on said support for downward movement, a common drive mechanism, means actuated by an initial operation of said common drive mechanism for moving said holder downwardly to engage said abutment with the stock and to position said blowpipe to start a cut, a crank arm on said blowpipe, and means actuated by further operation of said common drive mechanism to drive said crank arm for swinging said blowpipe about its pivot on said holder to advance the blowpipe for the cutting stroke.

2. In a blowpipe machine for cutting elongated metal stock, a blowpipe holder having a stock engaging abutment at the lower end thereof and a blowpipe pivoted thereon near the upper end thereof, a support for said blowpipe holder, linkage for mounting said holder on said support for swinging movement, a common fluid pressure drive cylinder, means actuated by pressure in said cylinder for moving said holder downwardly and forwardly to engage said abutment with the stock and position the blowpipe to start a cut, a crank arm on said blowpipe, and means actuated by continued pressure in said cylinder for driving said crank arm and thereby swinging said blowpipe about its pivot on said holder to advance the blowpipe for the cutting stroke.

3. In a blowpipe machine for cutting elongated metal stock, a blowpipe holder having a stock engaging abutment at the lower end thereof and a blowpipe pivoted thereon near the upper end thereof, a substantially vertical pedestal support for said holder, substantially parallel links one above the other respectively pivoted to said support and holder for mounting said holder for swinging movement, a common source of power, means actuated by said source of power for driving said holder for said swinging movement downwardly and forwardly to engage said abutment with the stock and position the blowpipe to start a cut, a crank arm on said blowpipe, and means actuated by further operation of said common source of power to drive said crank arm for swinging said blowpipe about its pivot on said holder to advance the blowpipe for the cutting stroke.

4. In a blowpipe machine for cutting elongated metal stock, a blowpipe holder having a stock engaging abutment at the lower end thereof and a blowpipe pivoted thereon near the upper end thereof, a support for said blowpipe holder, means for mounting said holder on said support for downward movement to engage said abutment with the stock and to position said blowpipe to start a cut, a crank arm on said blowpipe, and means for driving said crank arm to move said holder downward until said abutment engages the stock, and to thereafter swing said blowpipe about its pivot on said holder for the cutting stroke.

5. In a blowpipe machine for cutting elongated

metal stock, a carriage movable transversely to said stock, a blowpipe holder mounted on said carriage and having a blowpipe pivoted thereon near the upper end thereof, a stock engaging abutment on the forward end of said carriage, a stock engaging abutment at the bottom of said holder, means for moving said carriage transversely to the stock to engage its abutment with the side of said stock, means for mounting said holder on said carriage for downward movement to engage its abutment with the top of the stock and to position the blowpipe to start a cut, a crank arm on said blowpipe, and means for driving said crank arm and thereby for swinging said blowpipe about its pivot on said holder for the cutting stroke.

6. In a blowpipe machine for cutting elongated metal stock, a carriage movable transversely to said stock, a stock engaging trip at the forward

end of said carriage, a blowpipe holder mounted on said carriage for downward movement into operative position over the stock, a blowpipe pivoted on said holder for cutting movement across the stock, pressure actuated valves for turning on a supply of gases to said blowpipe, a fluid pressure conduit connected to said pressure actuated valves, and a valve in said fluid pressure conduit and actuated by said stock engaging carriage trip for actuating said gas valves.

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