Oct. 27, 1931. R. E. BRUCKNER 1,828,956

APPARATUS FOR CONTROL OF VARIABLE CUT-OFF VALVE GEARS

Filed Oct. 11, 1926 2 Sheets-Sheet 1

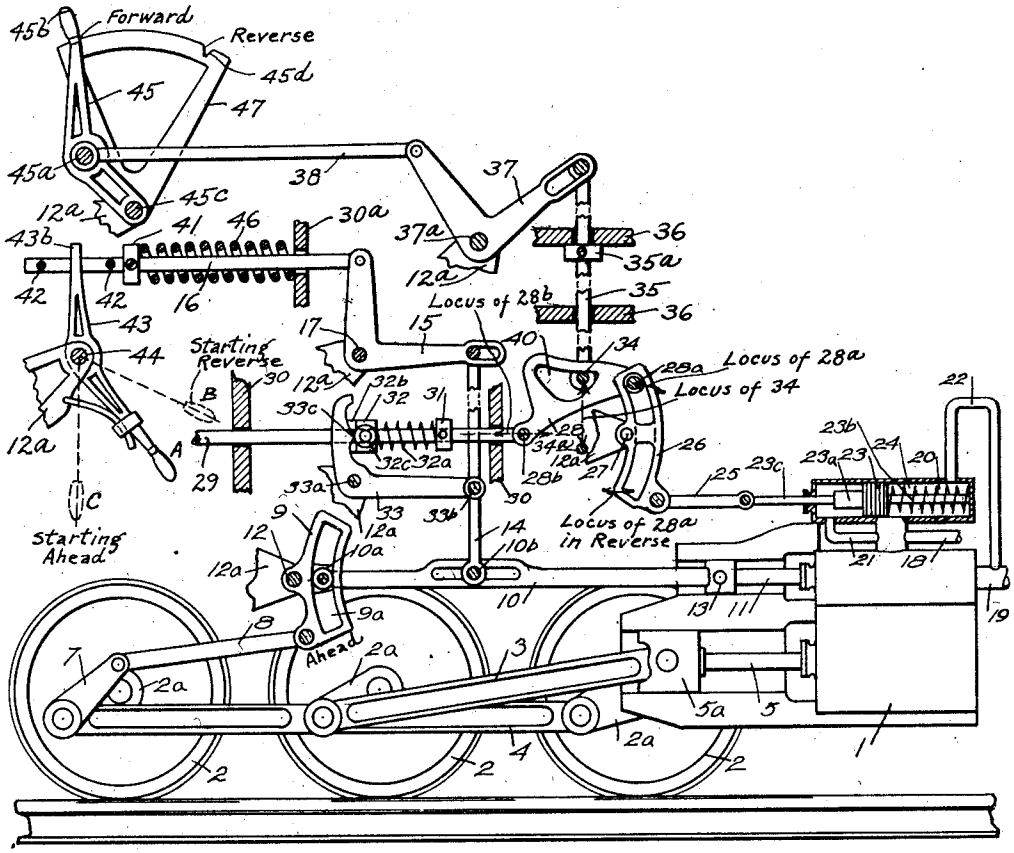


FIG. 1.

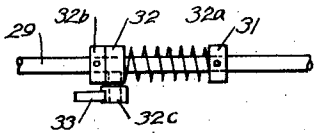


FIG. 2.

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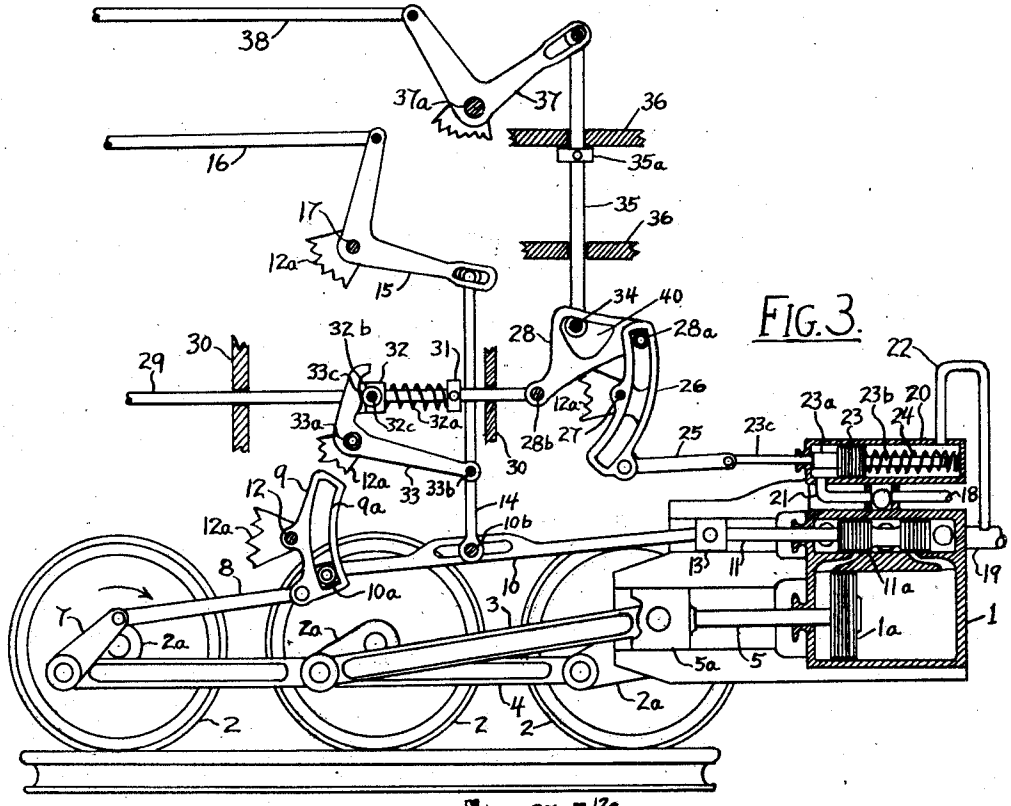


FIG. 3.

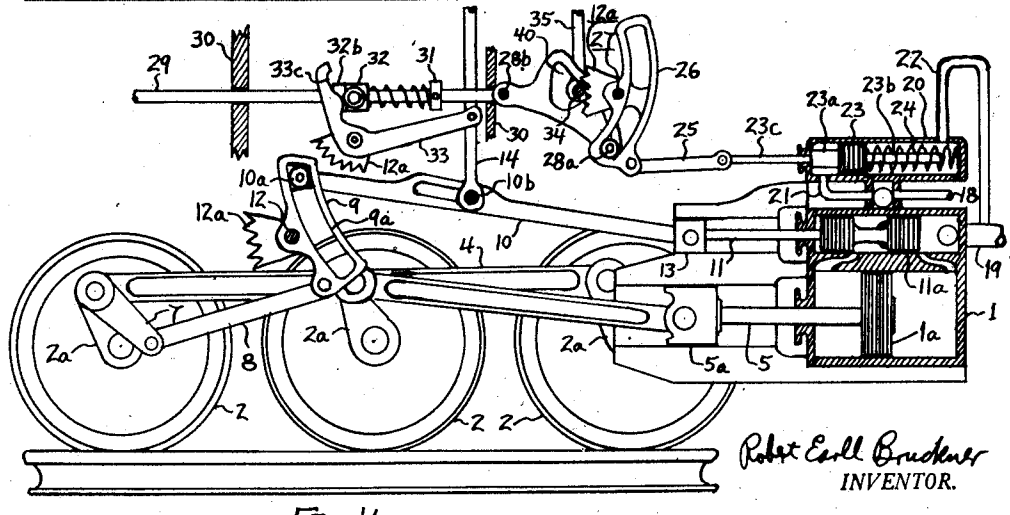


FIG. 4.

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Patented Oct. 27, 1931

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UNITED STATES PATENT OFFICE

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APPARATUS FOR CONTROL OF VARIABLE CUT-OFF VALVE GEARS

Application filed October 11, 1926. Serial No. 140,997.

It is desirable with certain types of engines and motors utilizing variable cut-off valve gears to vary the cut-off in response to the pressures of the fluids flowing to the motor and in some cases in response to the fluids flowing from the motor and in other cases in response to the pressures of the fluids both flowing to and from the motor. Such a motor is indicated in my copending application, Serial Number 137,158, filed Sept. 22nd, 1926 in which the actuating fluid of the motor is in a closed circuit, all of which is maintained substantially above atmospheric pressure. Under such conditions of use the most efficient use of the fluid in transmitting energy through the motor is accomplished by a cut-off responding to pressure changes in the fluid in the circuit. The present application provides a means whereby the cut-off will automatically respond to variations in pressure and control the cut-off to give it the most efficient location for the particular pressure conditions of the circuit and also may be utilized in giving to the motor conditions of operation in response to such pressure conditions making it more responsive or available for the transmission of energy as in the device of the type described in said application. Features and details of the invention will appear from the specification and claims.

An apparatus exemplifying the invention is shown in the accompanying drawings as follows:—

Fig. 1 shows a side elevation of the apparatus partly in section.

Fig. 2 a top view of a part of the control mechanism.

Fig. 3 shows a view similar to Fig. 1 with a variation in the set of the valve gear.

Fig. 4 a similar view with the valve gear set in reverse.

1 marks the motor cylinder 1*a* the piston in the cylinder, 2 the drive wheels of a locomotive, 3 the pitman, 4 the connecting rod between drive cranks 2*a* on the drive wheels, and 5 a piston rod connected with the piston of the motor and operating through the usual cross head 5*a*.

The valve gear is driven from a crank 7 carried by one of the drive wheels and delivers its motion through a link 8 to a slotted cut-off link 9 which is pivoted to a frame 12*a* at 12. A valve rod 11 is connected with any ordinary slide valve 11*a* and is connected through a joint 13 with the adjustable link 10. The adjustable link is connected with a sliding block 10*a* arranged in a slot 9*a* of the slotted link 9. The adjustable link 10 may be manually controlled through a link 14 which is connected with the adjustable link 10 through a pin and slot connection 10*b* and a bell crank lever 15. The bell crank lever is pivoted to the frame 12*a* by a pin 17 and is actuated by a manual cut-off control rod 16. This rod 16 extends through a guide plate 30*a* and is normally free to move when the cut-off is under the control of the automatic control mechanism hereinafter described. These parts operate in the manner of an ordinary variable cut-off reversible valve gear. A convenient control lever 43 is provided. This is pivotally mounted on a pin 44 carried by the frame 12*a* and is held in neutral position, shown in Fig. 1, by a spring 43*a*. The upper end 43*b* of the lever 43 engages pins 42—42 spaced apart on the rod 16 so that as the rod is moved through the automatic pressure device hereinafter described the lever 43 does not interefere with the free movement of the pin 16. The position of the handle is shown at neutral at A, as starting in reverse at B, and starting ahead at C. It is often desirable to balance the weight of the valve gear parts. A spring 46 is arranged around the rod 16 and is tensioned between the collar 41 and the guide 30*a*. This spring has a strength to approximately balance the weight of the valve linkage. The operating fluid is delivered to the motor through an inlet passage, or pipe 18 and the motor exhausts through a pipe 19.

The pressure responsive controlling device has a cylinder 20 and this cylinder is connected at one end with the inlet pipe 18 by a pipe 21. The opposite end of the cylinder is connected with the exhaust pipe 19 by a pipe 22. A piston 23 is arranged in the cylinder and is subjected to the opposing

pressures delivered to the cylinder through the pipes 21 and 22. It is also subjected to the action of a spring 24 which is added to the pressure delivered through the pipe 22 in opposing the pressure delivered from the intake through the pipe 21. The spring pressure varies with the movement of the piston and consequently gives a variable control in response to variations in pressure. A piston rod 23*c* extends from the piston 23 and is connected by a link 25 with the control reversing link 26. The link 26 is pivoted by a pin 27 on the frame 12*a*. A roller 28*a* is mounted in the slot of the control reversing link and has its pivotal support fixed on a link 28. The link 28 is connected by a pin 28*b* with a reciprocating rod 29 mounted in brackets 30 secured to the frame 12*a*. A collar 31 is fixed on the rod 29 and operates against a spring 32*a* which spring operates against a slidable block 32 carrying a roller 32*c*. The slidable block abuts a collar 32*b* on the rod limiting its movement and operates normally as a fixed member on the rod 29. The roller 32*c* operates against an arm of a bell crank 33, this bell crank being pivoted by a pin 33*a* on the frame 12*a* and the opposite end of the bell crank is connected by a pin 33*b* with the link 14. A stop 23*a* limits the movement of the piston toward the left when influenced by a decided drop in the intake pressure with a comparatively higher exhaust pressure and a stop 23*b* formed by a rod extending from the piston limits the movement of the piston 23 to the right under an excessive intake pressure. The link 28 is connected by a pin 34 with a rod 35. The rod 35 extends through brackets 36 forming a part of the frame and is connected with a bell crank lever 37. The bell crank lever is pivoted by means of a pin 37*a* on the frame 12*a* and is supplied with an operating rod 38 leading to a reversing lever 45, the rod 38 being connected to the reversing lever by a pin 45*a*. The reversing lever is pivoted on a pin 45*a* mounted on the frame 12*a*. A segment 47 is also carried by the frame. The usual locking pin 45*b* in the lever 45 is adapted to engage notches 45*d* to lock the lever in forward, or reverse position on the segment, thus locking the element 28 in forward or reverse position. The rod 35 is provided with a stop collar 35*a* which engages the brackets 36 and by means of which the throw of the pin 34 may be limited and consequently the movement of the lever 28 to the position it is desired to rock the arm 26. The pin 34 is arranged in a slot 40 and the walls of this slot are so formed as to permit the movement of the rocker link 26 under the influence of the piston carrying with it the rod 29. In forming this slot the upper wall of the slot should be such that it will follow the pin 34 as the roller 28*a* is rocked by the link 26 and the pin 28*b* moves with the axis of the rod 29. Similarly the lower part of the slot 40 should be formed so as to maintain the contact between the pin 34 in its lower position with the wall of the slot and the rocker 28*a* in its lower position is rocked with the link 26 and the pin 28*b* moves with the rod 29, the only purpose of the engagement being to maintain the rocker in its proper position in the link 26. The rod 35 may be maintained in its locked position, reverse or forward, and the control movement of the piston 23 be communicated through the member 28 to the rod 29.

The operation of the device is as follows: As shown in the drawings, Fig. 1, the intake pressure has reached a maximum and has forced the piston 23 to the right to the limit of its movement as controlled by the stop 23*b* and at this position it is at the zero or minimum point of cut-off. The stop 23*a* limits the movement of the piston in the direction of maximum cut-off in response to pressure conditions involving a comparative reduction in inlet pressure and an increase in exhaust pressure. With a drop in the pressure and a movement of the piston 23 to the left the rod 29, through the linkage, is moved toward the right permitting the link 14 to drop as the bell crank lever follows the rod 29, thus permitting the block 10*a* to move downwardly in the slot 9*a* and increase the cut-off. Fig. 3 shows the inlet pressure dropped to a minimum and a movement of the piston 23 to its extreme position to the left and a consequent movement of the rod 29 to its extreme position to the right.

If it is desired to reverse the operation of the linkage the link 28 is dropped to the position shown in Fig. 4 through the action of a rod 35.

It may be desirable to vary the cut-off responses slightly with relation to the movement of the piston 23 and this may be accomplished by forming the cam surfaces 33*c* on the face of the bell crank lever 33 engaged by the roller 32*c*. By shaping this cam any variation in response to cut-off to a given movement of the piston desired may be accomplished.

With this device it is possible to give any desired cut-off in response to conditions of pressure and this is of great importance with motors in certain situations, particularly in motors as indicated in my former application used as a transmission device for the transmission of power from a prime mover.

It will be understood that if desired the automatic pressure control of the cut-off may be entirely thrown out of action and the cut-off controlled manually through the action of the control rod 16 operating through the linkage on the adjusting link 10. This is permitted by the yielding linkage operating in the automatic control as provided by the spring 32*a*. It may be desirable to limit the

variations in cut-off through the pressure control and this is done in the present case by means of the stops 23*a* and 23*b* whereas with a manual control the point of cut-off may be carried beyond this point.

The invention as illustrated provides an automatic control of the cut-off for the predetermined desired degree of completeness of expansion, and also provides, if desired, an independent reversibility of the operation of the valve mechanism and also provides, if desired, an independent variation of the cut-off at the will of the operator through a range extending beyond the normal automatic control range.

What I claim as new is:—

1. In a motor, the combination of a motor cylinder having inlet and exhaust passages; a variable cut-off valve gear therefor; and a pressure device connected with the inlet and exhaust passages thereof and responsive to pressure differences therein varying the cut-off.

2. In a motor, the combination of a motor cylinder having inlet and exhaust passages; a variable cut-off valve gear therefor; and a pressure device connected with the inlet and exhaust passages thereof and responsive to pressure differences therein varying the cut-off, increasing the cut-off with an increase of pressure in the inlet and increasing the cut-off with a decrease of pressure in the exhaust.

3. In a variable cut-off motor, the combination of a motor cylinder having inlet and exhaust passages; a variable cut-off reversing valve gear therefor; a pressure device connected with the motor fluid passages and responsive to pressure differences therein; and a linkage between the pressure responsive device and the valve gear communicating the movement of the pressure responsive device to the valve gear with the valve gear in both forward and reverse positions.

4. In a variable cut-off motor, the combination of a motor cylinder having inlet and exhaust passages; a variable cut-off reversing valve gear therefor; a pressure device connected with the motor fluid passages and responsive to pressure differences therein; a linkage between the pressure responsive device and the valve gear communicating the movement of the pressure responsive device to the valve gear with the valve gear in both forward and reverse positions; and means reversing the valve gear and the linkage simultaneously.

5. In a motor, the combination of a motor cylinder having inlet and exhaust passages; a variable cut-off valve gear therefor; a pressure device connected with the fluid passages of the cylinder and responsive to pressure differences therein varying the cut-off; and means manually controlling the valve gear independently of the device.

6. In a variable cut-off motor, the combination of a motor cylinder having inlet and exhaust passages; a variable cut-off reversing valve gear therefor; a pressure device connected with the motor fluid passages and responsive to pressure differences therein; a linkage between the pressure responsive device and the valve gear communicating the movement of the pressure responsive device to the valve gear with the valve gear in both forward and reverse positions; and means manually reversing the valve gear independently of said device.

7. In a motor, the combination of a motor cylinder having inlet and exhaust passages; a variable cut-off valve gear therefor; a pressure device connected with the fluid passages of the cylinder and responsive to pressure differences therein varying the cut-off; means limiting the range of cut-off in response to the action of said device; and means manually controlling the valve gear, said manual means being adapted to extend or vary the cut-off beyond the range of variations of the cut-off in response to the device.

8. In a motor, the combination of a motor cylinder having inlet and exhaust passages; a variable cut-off valve gear therefor; a pressure device connected with the inlet and exhaust passages thereof and responsive to pressure differences therein varying the cut-off through a range corresponding and responding to a range of variations of fluid pressure in the passages; and a linkage between the pressure responsive device and the valve gear communicating the movement of the pressure responsive device to the valve gear in both forward and reverse positions.

In testimony whereof I have hereunto set my hand.

ROBERT EARLL BRUCKNER.