S. T. NELSON.

VALVE MECHANISM FOR HOISTING ENGINES.

APPLICATION FILED SEPT. 8, 1908. RENEWED DEC. 21, 1911.

1,034,024.

Patented July 30, 1912.

3 SHEETS—SHEET 1.

Fig. 1.

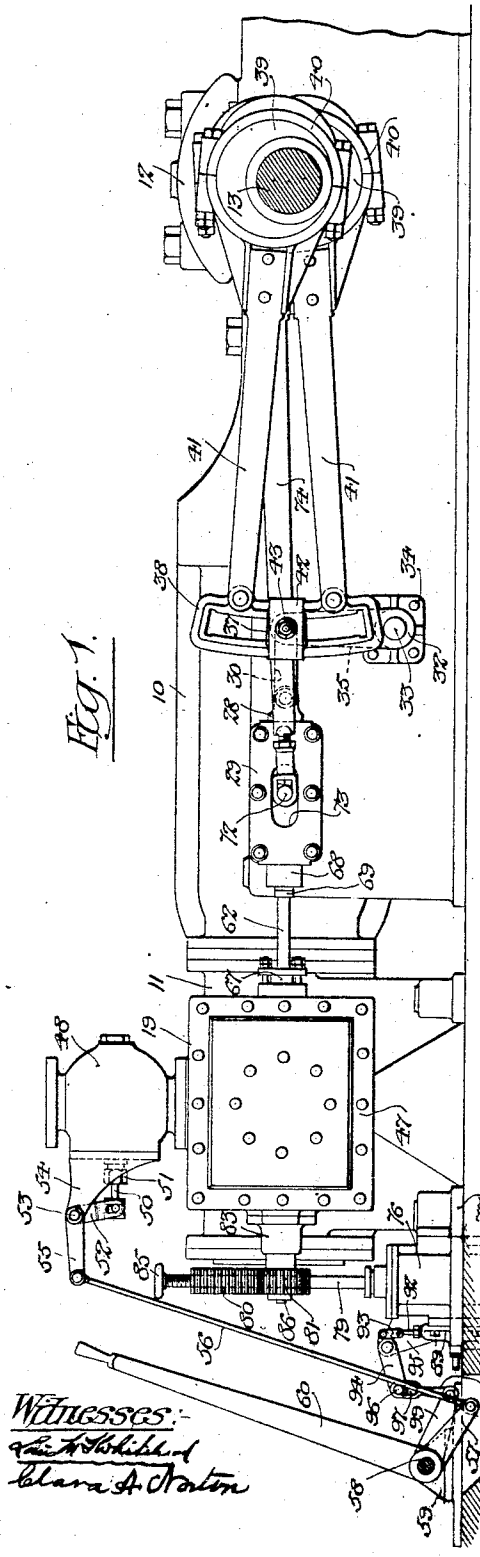
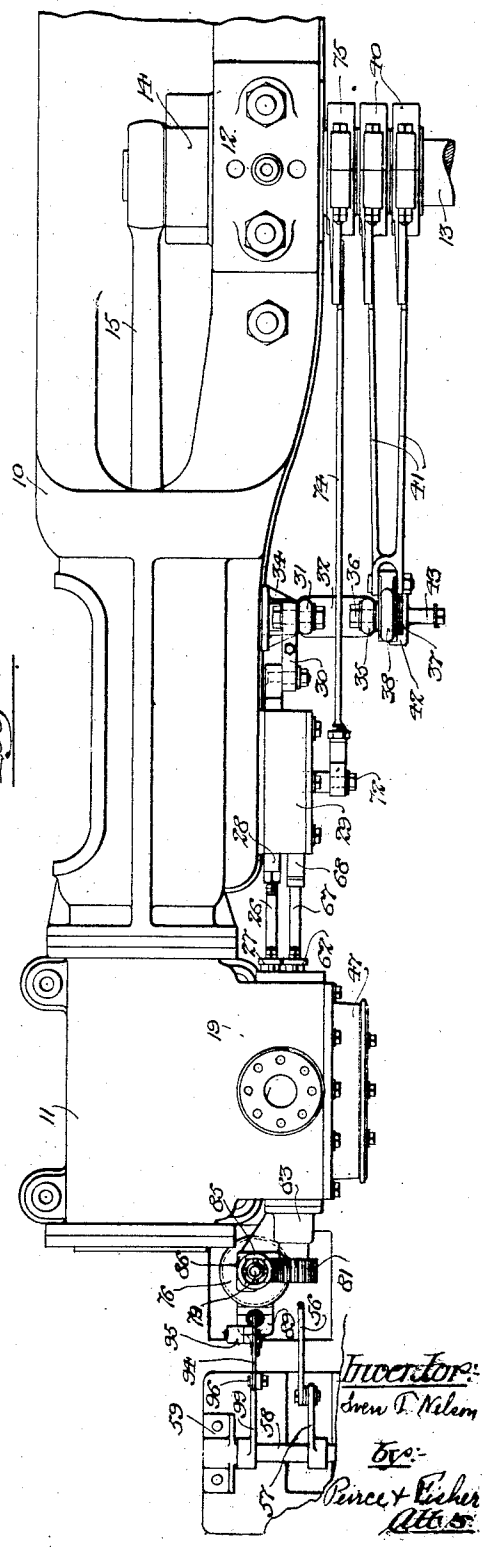


Fig. 2.



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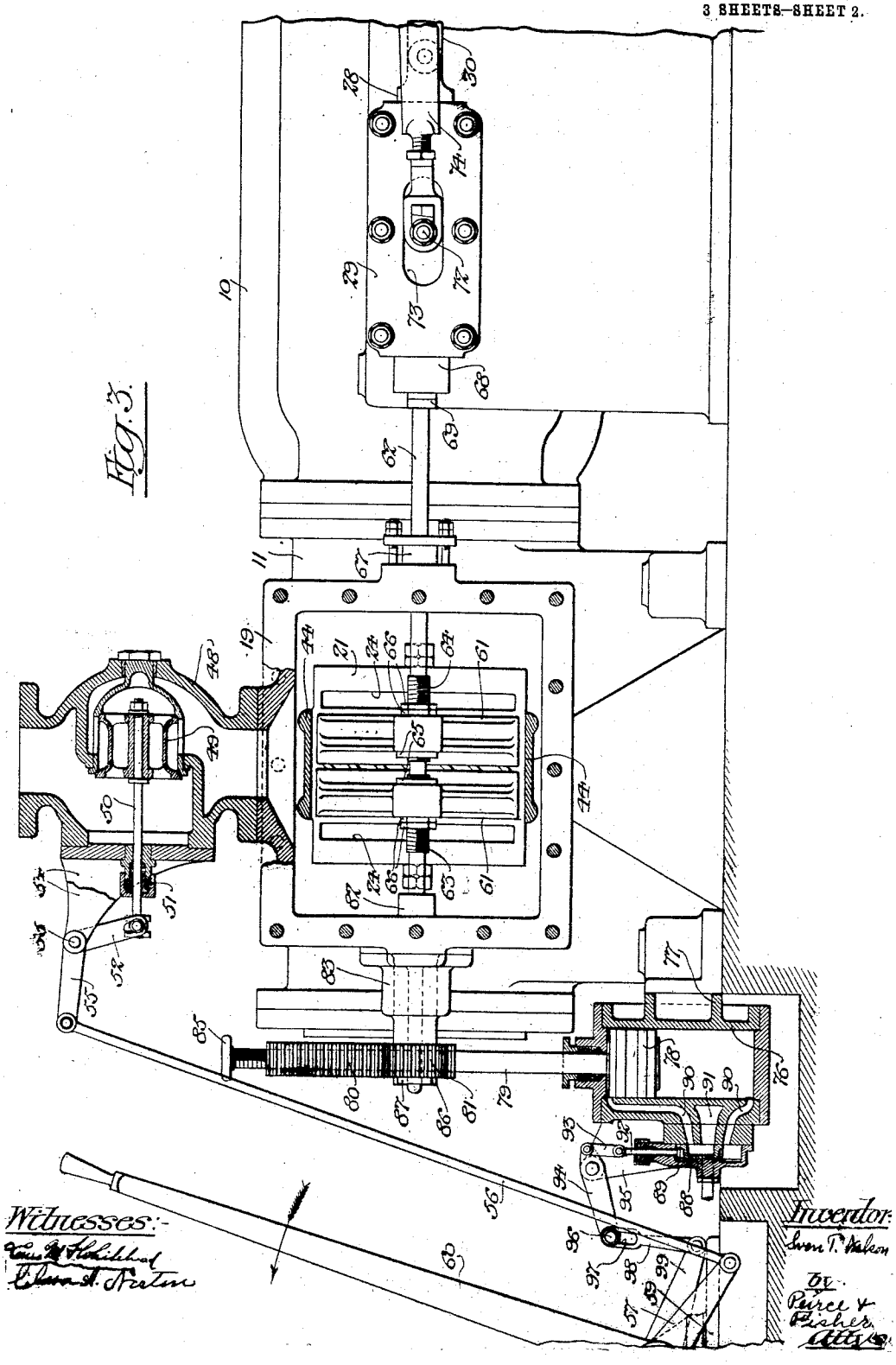
3 SHEETS—SHEET 2.

Fig. 3.



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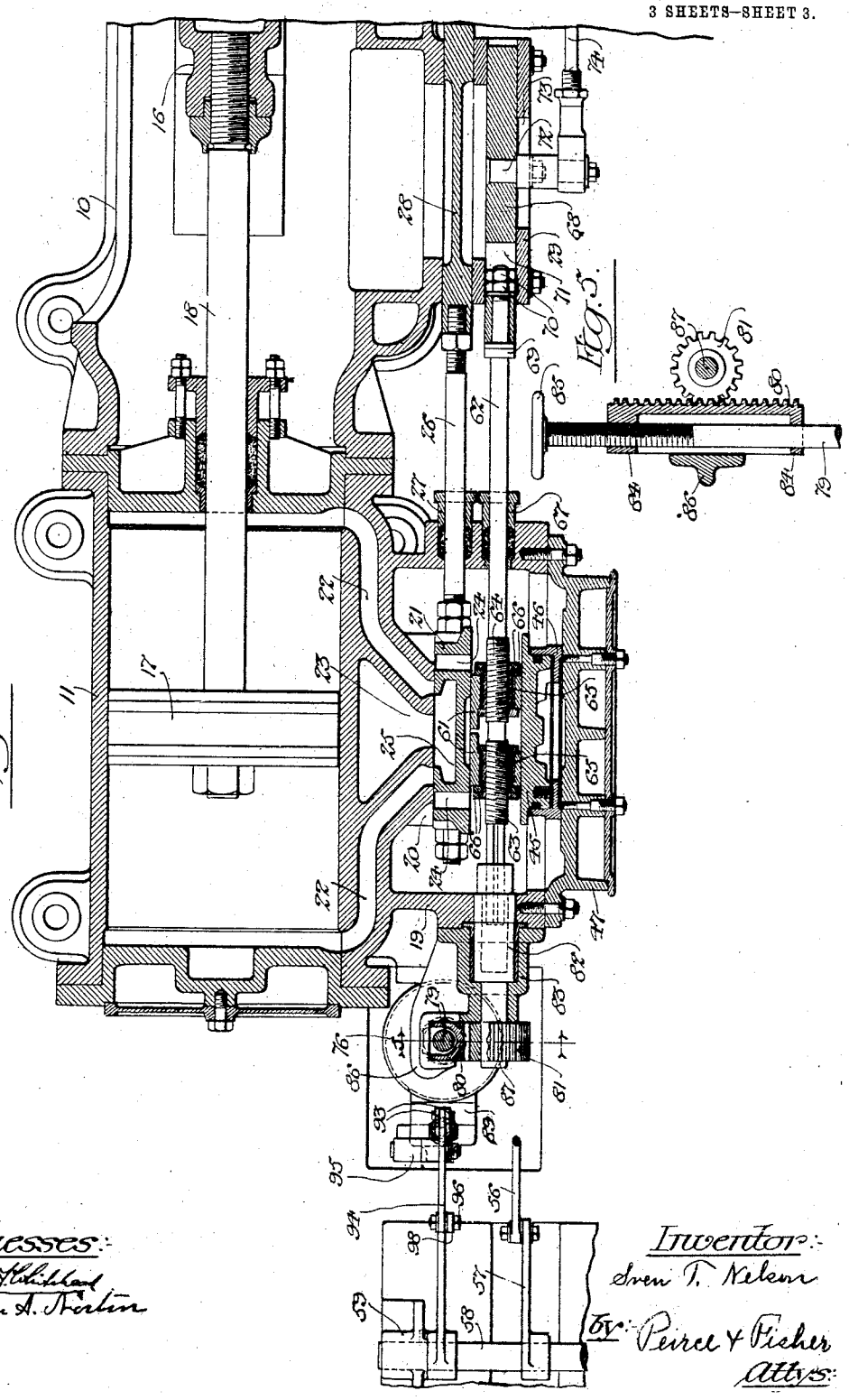
3 SHEETS—SHEET 3.

Fig. 4.



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ISM FOR HOISTING-ENGINES.

1,034,024.
Application filed September
cation of Letters Patent. Patented July 30, 1912.
o. 452,103. Renewed December 21, 1911. Serial No. 667,208.

To all whom it may conc

Be it known that I, SON, a citizen of the United S sident of Chicago, county of ate of Illinois, have invented d useful Improvements in m for Hoisting-Engines, of lowing is a specification.

The invention relate or like engines which must b started and stopped and with reatest amount of work is done load.

For economical oper ng engine should be provide mecha- nism arranged to admi rly the full length of the strok e when it is slowly starting it en the maximum speed is atta he load is well started, the val should be arranged to shorte o—say about one-fourth of th hat the steam may be econom by ex- pansion in the engine oisting engines employed for such as raising the cages or " shafts of mines, are usually of Corliss type in which the valve so con- trolled by the governo ne will take steam for the gre s stroke when it is slowly sta en full speed is attained, the short- ened by the automatic he gov- ernor-controlled valve thereby reduce the steam co ich en- gines are, however, qu and the slide valve mechanis engines cannot be readily gov d so as to well adapt it for t nditions under which a hoistin be op- erated.

The present invent dispense with governor contro hanism and to provide simpl , manu- ally controlled means shifting the adjustable cut-off a slide- valve or like engine s ine can take steam for nearly h of its stroke when starting of cut- off be reduced when ount of acceleration is attaine ans, the cheaper types of engi to meet the various conditions a hoist- ing engine must ope he same time, it can be opera w-steam consumption.

The invention also seeks to provide means whereby the engineer can simltaneously control the adjustable cut-off mechanism and the throttle valve of the engine with a single hand-lever or shifter.

The invention consists in the features of construction, combinations and arrangements of parts hereinafter set forth, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a view in elevation of a slide-valve engine with the present improvement applied thereto. Fig. 2 is a plan view of the same. Fig. 3 is a view in elevation on an enlarged scale of the valve mechanism with the cover of the valve chest removed and certain parts shown in central, vertical section. Fig. 4 is a view in central horizontal section of the parts shown in Fig. 3. Fig. 5 is a detail section on line 5—5 of Fig. 4.

The engine frame 10 may be of any suitable construction. At one end it is connected to the engine cylinder 11 and at its opposite end it is provided with a bearing 12 for the engine crank-shaft 13. A crank 14 on the shaft is engaged by a connecting rod 15 which is coupled at its inner end to a suitable cross-head 16. The cross-head (see Fig. 4) is connected as usual to the piston 17 of the engine by a piston-rod 18. The valve chest 19 is arranged on one side of the cylinder and is provided with a suitable valve seat 20 for a reciprocating slide-valve 21. Steam passages 22 as usual, lead from the valve seat 20 to the opposite ends of the engine cylinder 11 and an exhaust passage 23 opens through the valve seat between the ends of the steam passages 22. The slide-valve 21 is provided as usual with inlet ports 24 and exhaust cavity 25 for controlling the flow of steam to and from the opposite ends of the cylinder. A valve-rod 26 connected to the main slide-valve 21 extends through a stuffing-box 27 in the end wall of the valve chest 19 and is connected to a slide 28 that is guided in a suitable box 29 on the side of the engine frame. The forward end of the slide 28 (see Figs. 1 and 2) is connected by a link 30 to the inner arm 31 of a rocker 32. The rocker 32 is mou ed upon a shaft 33 carried by a brack on the side of the engine frame. T arm 35 of the rocker is connect

36 to a block 37 which is engaged by a link 38. A pair of eccentrics 39 on the engine shaft 13 are connected by eccentric straps 40 and rods 41 to the opposite ends of the link 38. A cross-piece 42 on the face of the link is provided with a projecting pin 43 by which the link is connected to the reversing lever. This reversible valve mechanism is of the well-known Stephenson link type and need not be more fully described. Other forms may be employed without departure from the essentials of the invention.

The main slide-valve 21 is provided with outwardly projecting lugs 44 (see Fig. 3) connected to a balancing plate 45 (see Fig. 4) which is seated within a slide 46. The latter moves upon a suitable seat formed upon the valve-chest cover 47. A throttle valve casing 48 is mounted upon the valve-chest 19 and communicates therewith, as shown in Fig. 3. A suitable throttle valve 49 arranged within the casing, is provided with a stem 50 which extends through a suitable stuffing-box 51 and is connected to an operating crank-arm 52 that is fixed to a short, horizontal shaft 53 journaled in lugs 54 that project from the throttle-valve casing. An arm 55 on the shaft 53 is connected by a rod 56 to an arm 57 on a shaft 58. This shaft is journaled in suitable brackets 59 and is provided with an operating hand-lever or shifter 60 by which the operator may open and close the throttle-valve 49 to admit steam to the engine valve-chest or cut off the supply thereto and thus start and stop the engine.

An auxiliary cut-off valve is employed in connection with the main slide-valve 21. Preferably, this auxiliary cut-off valve is of the Meyer type and comprises two sections arranged on the back of the main slide valve and between it and the balancing plate 45. A valve-rod 62 for reciprocating the auxiliary valve sections 61 is provided with right and left-hand screw-portions 63 and 64 which are threaded through sleeves 65. These sleeves are headed upon their inner ends and extend through openings in lugs on the auxiliary valve sections 61. Nuts 66 threaded upon the outer ends of the sleeves 65, securely clamp the same to the auxiliary valve sections 61. The valve-rod 62 extends through a stuffing-box 67 and is rotatably connected at its outer end to the inner end of a slide 68 which reciprocates in suitable guideways in the box 29. A collar 69 on the valve-rod engages the end of the slide 68 and nuts 70 are arranged within a recess 71 in the slide and are threaded upon the end of the valve-rod. The collar 69 and the nuts 70 connect the valve-rod to the slide, so that it and the auxiliary valve-sections 61 reciprocate with the slide, but the rod 62 is free to be rotated so that the screw-threaded portions 63 and 64 thereof can adjust the auxiliary valve sections 61 to and from each other to vary the point of cut-off through the inlet ports 24 of the main slide-valve 21 which are controlled by the auxiliary valve sections 61.

A pin 72 on the slide 68 extends outwardly through a slot 73 in the outer face of the box 29 and engages the inner end of a rod 74 that is connected by an eccentric strap 75 (see Fig. 2) to a third eccentric upon the engine shaft 13. The auxiliary valve sections are thus reciprocated to control the inlet ports 24 of the main slide-valve 21 and these valve sections may be adjusted to and from each other by rotating the valve-rod 62 to vary the point of cut-off. When the valve sections are close together, as shown in the drawings, the engine cylinder will take steam for nearly the full length of its stroke. When the valve sections 61 are separated, the cut-off will be correspondingly shortened.

While the form of auxiliary cut-off valve shown is preferred, other forms may be employed and other means of adjustment provided therefor without departure from the essentials of the invention.

An auxiliary motor is provided for effecting the quick adjustment of the auxiliary cut-off valve. In the form shown, this auxiliary motor comprises a small upright cylinder 76 carried upon a base-plate 77 adjacent and below the head end of the main engine cylinder 11. A piston 78 in the auxiliary cylinder 76 is provided with an upwardly extending piston-rod 79 that is connected to a rack 80. This rack meshes with the teeth of a pinion 81 on the outer end of a sleeve 82. This sleeve is rotatably mounted in a bracket 83 upon the end of the valve-chest 19, and the sleeve extends through the wall of the valve-chest and engages the end of the valve-rod 62. The valve-rod extends within the sleeve and is keyed thereto so as to rotate with the sleeve, but the valve rod is free to reciprocate independently thereof. The sleeve 82 is hollow, as indicated in dotted lines in Fig. 4, to receive the end of the reciprocating valve rod 62 which is keyed thereto. A solid extension 87 on the sleeve projects out through the end of the bracket or bearing 83 and carries the pinion or gear 81. By admitting steam or other fluid under pressure to the opposite ends of the auxiliary cylinder 77, the piston 78 and rack-bar 80 may be quickly shifted to rotate the valve-rod 62 and adjust the auxiliary valve sections 61 to and from each other to vary the point of cut-off. The engagement of the piston 78 with the ends or heads of the auxiliary cylinder 77 limits the relative shift of the auxiliary valve sections 61. That is to say, the heads of the auxiliary cylinder act as stops to limit the relative adjustment of the auxil-

iary valve sections. piston 78 is at the upper end of i nt, the valve sections are close to the engine cylinder will take s bout three-quarters of its stroke e piston 78 is at the lower end of ent, the auxiliary valve sections moved apart and the point of cut engine will be reduced to about of its stroke. The points of cut-off treme limits of the relative shift iliary valve sections 61 are pref ustable, and for this purpose the 79 extends through lugs 84 on t the rack-bar 80 and is adjustably through one of the lugs and is ith a hand-wheel 85 on its uppe at the rack-bar 80 and the auxi sections 61 operatively connecte can be adjusted relative to the of the auxiliary engine. The r is arranged within a guide 86 u cket 83 and is held thereby aga n with the piston-rod 79.

A slide-valve 88 within the steam chest 89 of t uxiliary engine cylinder 76 and e steam and exhaust passages 90 anually operative means are pr shifting the valve 88 to thereby c ow of steam or other motive fluid m the opposite ends of the aux nder 76. In starting the engine u d, the valve 88 will be positioned in the drawings, to connect the of the cylinder to the steam sup e upper end to the exhaust, so th n 78 will be shifted to its upper n, as shown in the drawings, an iliary valve sections 61 will be b se together. Then, on opening t e-valve and starting the engine, e steam for nearly the full length oke. After the desired speed h ttained, the operator, by shifting 8 to connect the upper end of the cylinder 76 to the source of suppl ower end to the exhaust, can quick e piston 78 and the auxiliary val g means to separate the sections e auxiliary valve and thereby qu en the cut-off to the desired mi n this way the engine may be s y and economically employed ing engine. The valve mechanism set that the engine will quickly s load and, when the load is start e work required of the engine educed, the steam consumption i n and the steam economically u expansion in the engine cylinder.

The valve 88 of the engine cylinder 76 is preferably d from the throttle-lever or shift r this purpose, the stem 92 of t s connected by a link 93 to the inner end of a short arm or lever 94. This arm is pivoted adjacent its inner end upon a bracket or lug 95 that projects from the auxiliary cylinder 76. The outer end of the arm 94 is provided with a pin 96 which extends through a slot 97 in the upper end of a link 98. The link 98 is pivotally connected at its lower end to an arm 99 on the shaft 58 to which the throttle lever or shifter 60 is connected.

In the position of the parts shown in the drawings the throttle-valve 49 is closed and the valve 88 is then held in position to admit steam to the lower end of the cylinder 76 so that the piston 78 is at the upper end of its movement, as shown, and the auxiliary valve sections 61 are close together so that the cut-off will occur at a point near the end of the stroke of the engine piston. In this position of the parts the pin 96 on the arm 94 will be at the upper end of the slot 67 as shown. To open the throttle valve 49 and start the engine, the shifter or lever 60 is moved in the direction indicated by the arrow in Fig. 3. In starting the engine, the throttle-lever or shifter is moved part way to open the throttle-valve. This part movement of the shifter merely serves to take up the lost-motion between the arm 94 and the link 98 so that the valve 88 is not shifted and the auxiliary valve sections 61 remain in position to effect a long cut-off. When the load is started and the desired speed acquired, the operator shifts the lever 60 to the end of its movement to fully open the throttle-valve 49 and thereby, through the medium of the link 98 and arm 94, shifts the valve 88 to admit steam to the upper end of the auxiliary cylinder 76 to shift the piston 78, separate the auxiliary valve sections 61 and shorten the cut-off. When the shifter 60 is moved back to the position shown in the drawings to close the throttle-valve and stop the engine, the valve 88 also will be shifted to admit steam to the lower end of the auxiliary cylinder, raise the piston 78 and bring the auxiliary valve sections together. The parts will then be in position to admit steam for the greater part of the stroke of the engine when it is again started.

While only a single engine is shown, it will be understood that, as usual in this class of machine, the engine will be arranged in duplicate at opposite ends of the shaft 13 with cranks on the shaft arranged at an angle of ninety degrees to each other, so that there will be no dead center and the engines may be started from any position. The constructions of both engines will be alike and the shaft 58 will be provided with two arms 57 for controlling the throttle valves of the two engines and with two arms 99 for controlling the adjusting mechanism for the auxiliary cut-off valves. The shaft,

however, will have but a single controlling lever or shifter 60, so that the throttle valves and adjusting devices for the cut-off valves of both engines may be simultaneously controlled.

It is obvious that numerous changes may be made from the details set forth without departure from the invention as defined in the claims.

I claim as my invention:—

1. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor, an auxiliary cut-off valve, means operated by the engine for reciprocating said main and cut-off valves, means for adjusting said cut-off valve to vary the point of cut-off, an auxiliary motor for throwing said adjusting means to the opposite ends of its movement, and manually operated devices controlling the operation of said auxiliary motor, substantially as described.

2. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor, an auxiliary cut-off valve, means operated by the engine for reciprocating said main and cut-off valves, means for adjusting said cut-off valve to vary the point of cut-off, an auxiliary engine cylinder, a piston therein operatively connected to said adjusting means, stopping means limiting the throw of said piston and said adjusting means and a manually operated valve mechanism controlling the flow of fluid under pressure to and from said auxiliary cylinder, substantially as described.

3. In a hoisting engine, the combination with the engine cylinder, of a main slide valve therefor having inlet and exhaust ports, an auxiliary cut-off slide valve on the back of said main slide valve and controlling the inlet ports thereof, reversible valve operating mechanism for reciprocating said main slide valve, operating means for reciprocating said auxiliary slide valve, means for adjusting said slide valve relatively to its operating means to vary the point of cut-off, an auxiliary engine cylinder, a piston therein operatively connected to said adjusting means to throw the same to the opposite ends of its movement and a manually operated valve controlling the flow of motive fluid to and from said auxiliary cylinder, substantially as described.

4. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor, an auxiliary cut-off valve, means operated by the engine for reciprocating said main and cut-off valves, means for adjusting said cut-off valve to vary the point of cut-off, an auxiliary engine cylinder, a piston therein, adjustable operating connections between said piston and the adjusting means for said auxiliary cut-off valve, and a manually operated valve mechanism controlling the flow of motive fluid to and from said auxiliary cylinder, substantially as described.

5. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor having inlet and exhaust ports, an auxiliary valve comprising two sections controlling the inlet ports of said main valve, means driven by the engine for reciprocating said main and auxiliary valves, and auxiliary motor, reciprocating means operated thereby for adjusting the sections of said auxiliary valve to and from each other to vary the point of cut-off, stopping means limiting the throw of said piston and said adjusting means and manually operated devices for controlling said auxiliary motor, substantially as described.

6. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor having inlet and exhaust ports, an auxiliary valve comprising two sections controlling the inlet ports of said main valve, reversible valve operating mechanism for reciprocating said main valve, operating means for reciprocating said auxiliary valve, an auxiliary cylinder, a piston therein, means operated by said piston for adjustng said auxiliary valve sections to and from each other, and manually operated valve mechanism controlling the flow of motive fluid to and from said auxiliary cylinder to throw said valve sections to the opposite ends of their adjustment, substantially as described.

7. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor having inlet and exhaust ports, an auxiliary valve comprising two sections controlling the inlet ports of said main valve, means driven from the engine for reciprocating said main and auxiliary valves, means for adjusting said auxiliary valve sections to and from each other, an auxiliary engine cylinder, a piston therein, adjustable connections between said piston and said adjusting means for said auxiliary valve sections and manually operated valve mechanism for said auxiliary cylinder, substantially as described.

8. In a hoisting engine, the combination with the engine cylinder, of a main slide valve therefor having inlet and exhaust ports, reversible valve operating mechanism for reciprocating said valve, an auxiliary cut-off valve comprising two sections on the back of said main valve and controlling the inlet ports thereof, a rotatable valve rod having right and left hand screw portions threaded respectively through said auxiliary valve sections, means driven by the engine for reciprocating said valve rod, an auxiliary motor, means operated thereby for rotating said valve rod and manually operated devices controlling said auxiliary motor, substantially as described.

9. In a hoisting engine, the combination

with the engine cylinder, o slide valve therefor having inle xhaust ports, reversible, valve opera anism for reciprocating said valv xiliary cut-off valve comprising two on the back of said main valve and ng the inlet ports thereof, a rotat e rod having right and left-hand rtions threaded respectively throug xiliary valve sections, means driven engine for reciprocating said valve tatable part to which said valve ro ed, an auxiliary engine cylinder, a herein operatively connected to said e part, to throw said valve sections posite ends of their adjustment, a oper- ated valve mechanism for xiliary cylinder, substantially as de

10. In a hoisting engine, t nation with the engine cylinder, o slide valve therefor having inle xhaust ports, reversible valve opera anism for reciprocating said valv xiliary cut-off valve comprising two on the back of said main valve and ng the inlet ports thereof, a rotat e rod having right and left hand rtions threaded respectively throug xiliary valve sections, means driven engine for reciprocating said valve tatable part to which said valve ro ed, an auxiliary cylinder, a piston adjust- able connections between s n and said rotatable part and ma erated valve mechanism for said au linder, substantially as described.

11. In a hoisting engine, t nation with the engine cylinder, o slide valve therefor having inle xhaust ports, reversible valve opera anism for reciprocating said valv xiliary cut-off valve comprising two on the back of said main valve and ng the inlet ports thereof, a rotat e rod having right and left hand rtions threaded respectively throug xiliary valve sections, means driven engine for reciprocating said valve tatable sleeve to which said valve yed, a pinion on said sleeve, a rack g said pinion, an auxiliary cylinder there- in connected to said rack an ly, op- erated valve mechanism for xiliary cylinder, substantially as des

12. In a hoisting engine, t nation with the engine cylinder, o slide valve therefor having inle xhaust ports, reversible valve opera anism for reciprocating said valv xiliary cut-off valve comprising two on the back of said main valve and ng the inlet ports thereof, a rotat e rod having right and left hand rtions threaded respectively throu auxil- iary valve sections, means by the engine for reciprocating said valve rod, a rotatable sleeve to which said valve rod is keyed, a pinion on said sleeve, a rack engaging said pinion, an auxiliary cylinder, a piston therein having a piston rod adjustably screw threaded to said rack and a manually operated valve for said auxiliary cylinder, substantially as described.

13. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor, an auxiliary cut-off valve, operating means driven by the engine for reciprocating said main and auxiliary valves, means for adjusting said cut-off valve relatively to its operating means to vary the point of cut-off, a throttle valve for the engine, a manually operated shifter for said throttle valve, and means operated by said shifter for actuating the adjusting means for said auxiliary cut-off valve, substantially as described.

14. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor, an auxiliary cut-off valve, operating means driven by the engine for reciprocating said main and auxiliary valves, means for adjusting said cut-off valve relatively to its operating means to vary the point of cut-off, a throttle valve for the engine, a manually operated shifter for said throttle valve, and a motor controlled by said shifter after a predetermined part movement thereof for throwing said adjusting means, substantially as described.

15. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor, an auxiliary cut-off valve, operating means driven by the engine for reciprocating said main and auxiliary valves, means for adjusting said cut-off valve relatively to its operating means to vary the point of cut-off, a throttle valve for the engine, a manually operated shifter for said throttle valve, means operated by said shifter for actuating said adjusting means and means for adjusting said auxiliary cut-off valve independently of said shifter, substantially as described.

16. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor, an auxiliary cut-off valve, operating means driven by the engine for reciprocating said main and auxiliary valves, means for adjusting said cut-off valve relatively to its operating means to vary the point of cut-off, a throttle valve for the engine, a manually operated shifter for said throttle valve, an auxiliary motor for actuating said adjusting means and means operated by said shifter for controlling said motor, substantially as described.

17. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor, an auxiliary cut-off valve, operating means driven by the engine for re-

ciprocating said main and auxiliary valves, means for adjusting said cut-off valve relatively to its operating means to vary the point of cut-off, a throttle valve for the engine, a manually operated shifter for said throttle valve, an auxiliary engine cylinder, a piston therein operatively connected to said adjusting means, a controlling valve for said cylinder and lost motion, operating connections between said valve and said shifter, substantially as described.

18. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor, an auxiliary cut-off valve, operating means driven by the engine for reciprocating said main and auxiliary valves, means for adjusting said cut-off valve relatively to its operating means to vary the point of cut-off, a throttle valve for the engine, a manually operated shifter for said throttle valve, an auxiliary engine cylinder, a piston therein, adjustable operating connections between said piston and the adjusting means for said auxiliary cut-off valve, valve mechanism controlling the flow of motive fluid to and from said auxiliary cylinder and operating connections between said valve mechanism and said shifter, substantially as described.

19. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor having inlet and exhaust ports, an auxiliary valve comprising two sections controlling the inlet ports of said main valve, means driven by the engine for reciprocating said valves, a throttle valve for the engine, a manually operated shifter for said throttle valve and means operated by said shifter for adjusting said auxiliary cut-off valve sections to and from each other to vary the point of cut-off, substantially as described.

20. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor having inlet and exhaust ports, an auxiliary valve comprising two sections controlling the inlet ports of said main valve, means driven by the engine for reciprocating said valves, a throttle valve for the engine, a manually operated shifter for said throttle valve and means actuated by said shifter after a part movement thereof for adjusting said cut-off valve sections to and from each other, substantially as described.

21. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor having inlet and exhaust ports, an auxiliary valve comprising two sections controlling the inlet ports of said main valve, means driven by the engine for reciprocating said valves, a throttle valve for the engine, a manually operated shifter for said throttle valve, means actuated by said shifter after a part movement thereof for adjusting said cut-off valve sections to and from each other to vary the point of cut-off, and means for adjusting said valve sections independently of said shifter, substantially as described.

22. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor having inlet and exhaust ports, an auxiliary valve comprising two sections controlling the inlet ports of said main valve, means driven by the engine for reciprocating said valves, a throttle valve for the engine, a manually operated shifter for said throttle valve, an auxiliary motor, means operated thereby for adjusting said cut-off valve sections to and from each other to vary the point of cut-off and means for controlling said auxiliary motor operated by said shifter, substantially as described.

23. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor having inlet and exhaust ports, an auxiliary valve comprising two sections controlling the inlet ports of said main valve, means driven by the engine for reciprocating said valves, a throttle valve for the engine, a manually operated shifter for said throttle valve, an auxiliary engine cylinder, a piston therein, means operatively connected to said piston for adjusting said cut-off valve sections to and from each other, and valve mechanism for said auxiliary cylinder operatively connected to said shifter, substantially as described.

24. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor having inlet and exhaust ports, an auxiliary valve comprising two sections controlling the inlet ports of said main valve, means driven by the engine for reciprocating said valves, a throttle valve for the engine, a manually operated shifter for said throttle valve, an auxiliary engine cylinder, a piston therein, means operatively connected to said piston for adjusting said cut-off valve sections to and from each other, controlling valve mechanism for said auxiliary cylinder and lost motion operative connections between said valve mechanism and said shifter, substantially as described.

25. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor having inlet and exhaust ports, an auxiliary valve comprising two sections controlling the inlet ports of said main valve, means driven by the engine for reciprocating said valves, a throttle valve for the engine, a manually operated shifter for said throttle valve, an auxiliary engine cylinder, a piston therein, means operatively connecting to said piston for adjusting said cut-off valve sections to and from each other, said connecting means being adjustable to effect an independent adjustment of said valve sections, controlling valve mechanism

for said auxiliary engine and con
between said valve mechanism a
shifter, substantially as described.

26. In a hoisting engine, the com
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and controlling the inlet ports th
rotatable valve rod having right
hand screw portions engaging said
valve sections, means driven by th
for reciprocating said valve rod, a
member to which said valve rod is
throttle valve for the engine, a sh
said throttle valve, and means ope
said shifter for rotating said mem
stantially as described.

27. In a hoisting engine, the com
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movement thereof for rotating said
substantially as described.

28. In a hoisting engine, the com
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hand screw portions engaging said
valve sections, means driven by th
for reciprocating said valve rod, a
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throttle valve for the engine, a sh
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operatively connected to said shif
stantially as described.

29. In a hoisting engine, the com
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by the engine for reciprocating sa
an auxiliary cut-off slide valve, co
two sections on the back of said ma
and controlling the inlet ports thereof, a rotatable valve rod having right and left hand screw portions engaging said auxiliary valve sections, means driven by the engine for reciprocating said valve rod, a rotatable member to which said valve rod is keyed, a throttle valve for the engine, a shifter for said throttle valve, an auxiliary engine cylinder, a piston therein, adjustable operating connections between said piston and said rotatable member, a controlling valve for said auxiliary cylinder, and operating, lost motion connections between said valve and said shifter, substantially as described.

30. In a hoisting engine, the combination with the engine cylinder, of a throttle valve therefor, a shifter for said valve, a main slide valve having inlet and exhaust ports, reversible valve operating mechanism driven by the engine for reciprocating said valve, an auxiliary cut-off slide valve comprising two sections on the back of said main valve and controlling the inlet ports thereof, a rotatable valve rod having right and left hand screw portions engaging said auxiliary valve sections, means driven by the engine for reciprocating said valve rod, a rotatable sleeve to which said valve rod is keyed, a pinion on said sleeve, a rack engaging said pinion, an auxiliary engine cylinder, a piston therein connected to said rack and controlling valve mechanism for said auxiliary cylinder connected to said shifter, substantially as described.

31. In a hoisting engine, the combination with the engine cylinder, of a throttle valve therefor, a shifter for said valve, a main slide valve having inlet and exhaust ports, reversible valve operating mechanism driven by the engine for reciprocating said valve, an auxiliary cut-off slide valve comprising two sections on the back of said main valve and controlling the inlet ports thereof, a rotatable valve rod having right and left hand screw portions engaging said auxiliary valve sections, means driven by the engine for reciprocating said valve rod, a rotatable sleeve to which said valve rod is keyed, a pinion on said sleeve, a rack engaging said pinion, an auxiliary engine cylinder, a piston therein adjustably connected to said rack, a controlling valve for said auxiliary cylinder and operating, lost-motion connections between said valve and said shifter, substantially as described.

32. In a hoisting engine, the combination with the engine cylinder, of a main valve therefor having inlet and exhaust ports, an auxiliary cut-off valve controlling the inlet ports of said main valve, operating means driven by the engine for reciprocating said main and cut-off valves, an auxiliary motor, means operated thereby for adjusting said cut-off valve relatively to its operating means to vary the point of cut-off and means

for adjusting said cut-off valve independently of said auxiliary motor, substantially as described.

33. In a hoisting engine, the combination with the engine cylinder, of a main slide valve therefor having inlet and exhaust ports, an auxiliary cut-off valve comprising two sections on the back of said main slide valve and controlling the inlet ports thereof, means driven by the engine for reciprocating said valves, an auxiliary engine comprising a cylinder and a piston in said cylinder, means operated by said piston to adjust said auxiliary valve sections to and from each other to vary the point of cut-off, means for adjusting said valve sections independently of said auxiliary engine and manually operative valve mechanism controlling the flow of motive fluid to and from said auxiliary engine, substantially as described.

34. In a hoisting engine, the combination with the engine cylinder, of valve mechanism therefor driven by the engine, a shiftable member for changing the point of cut-off of said valve mechanism, an auxiliary motor cylinder, a piston therein, adjustable operating connections between said piston and said cut-off adjusting member for throwing the latter to the opposite ends of its movement, valve mechanism controlling the flow of motive fluid to and from the opposite ends of said auxiliary cylinder, and a hand lever connected to said valve mechanism.

35. In an engine, the combination with the engine cylinder, of valve mechanism driven from the engine controlling the admission and exhaust of motive fluid to and from said cylinder, a shiftable member for varying the point of cut-off of said valve mechanism, a throttle valve for the engine, a manually operated shifter for said throttle valve, and means operated by said shifter for actuating said cut-off adjusting member.

36. In an engine, the combination with the engine cylinder, of valve mechanism driven from the engine controlling the admission and exhaust of motive fluid to and from said cylinder, a shiftable member for varying the point of cut-off of said valve mechanism, a throttle valve for the engine, a manually operated shifter for said throttle valve, and means operated by said shifter after a pre-determined part movement thereof for actuating said cut-off adjusting member.

37. In an engine, the combination with the engine cylinder, of valve mechanism driven from the engine controlling the admission and exhaust of motive fluid to and from said cylinder, a shiftable member for varying the point of cut-off of said valve mechanism, a throttle valve for the engine, a manually operated shifter for said throttle valve, an auxiliary motor for actuating said cut-off adjusting member, and means actuated by said throttle valve shifter for controlling said motor.

38. In an engine, the combination with the engine cylinder, of valve mechanism driven from the engine controlling the admission and exhaust of motive fluid to and from said cylinder, a shiftable member for varying the point of cut-off of said valve mechanism, a throttle valve for the engine, a manually operated shifter for said throttle valve, an auxiliary engine cylinder, a piston therein operatively connected to said cut-off adjusting member, controlling valve mechanism for said cylinder, and lost motion, operating connections between said shifter and said valve mechanism, whereby the valve mechanism of said auxiliary cylinder is operated after a pre-determined part movement of said throttle valve shifter, substantially as described.

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Witnesses:
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