(No Model.) 3 Sheets—Sheet 1.

# R. M. BAILY, Jr.

## VALVE GEAR.

No. 386,284. Patented July 17, 1888.

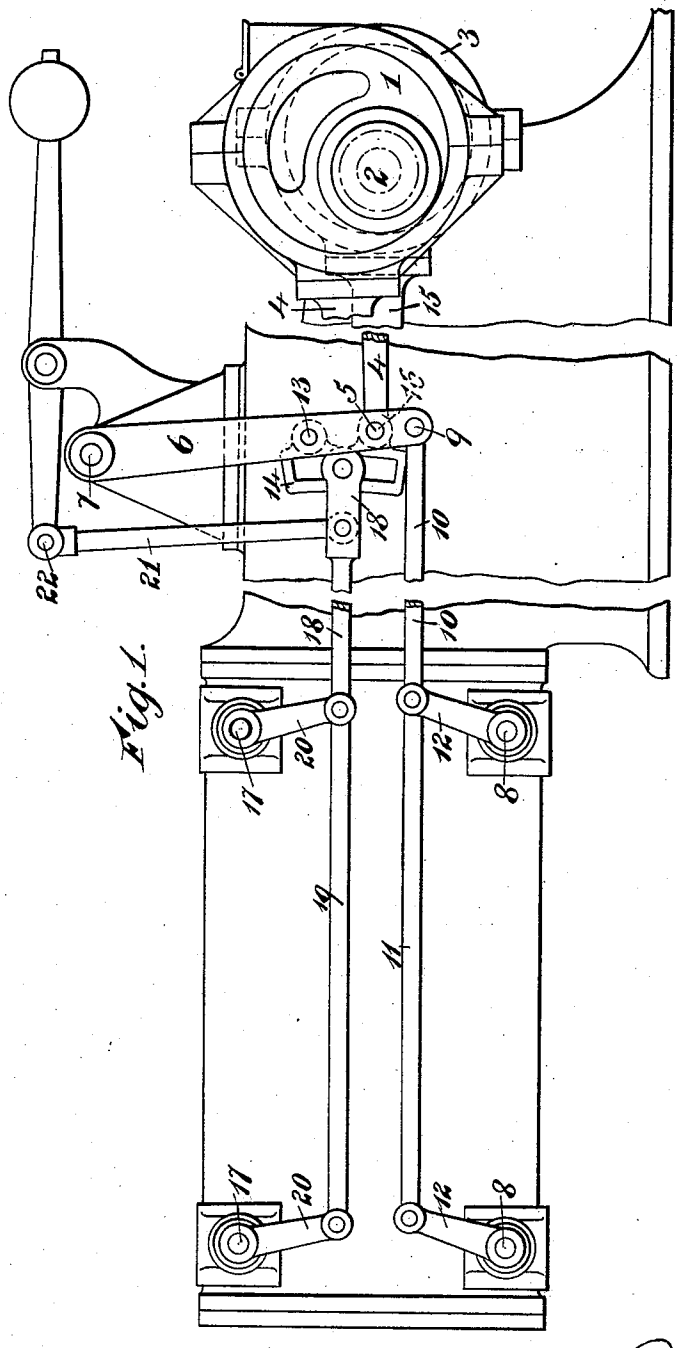


Fig. 1.

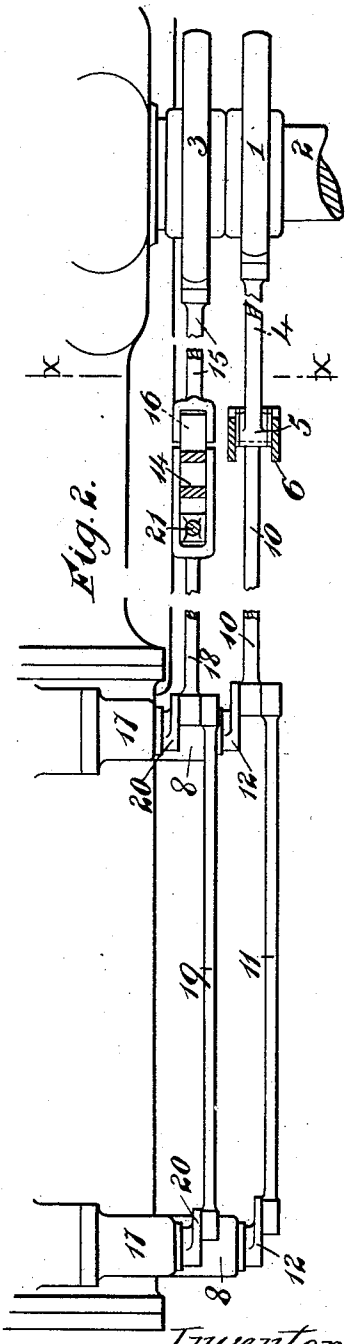


Fig. 2.

Witnesses.
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Ackland & Boyle

Inventor.
Robert M. Baily Jr.
by his attorney
Thomas Spencer Stetson

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

# R. M. BAILY, Jr.

## VALVE GEAR.

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Fig. 4.

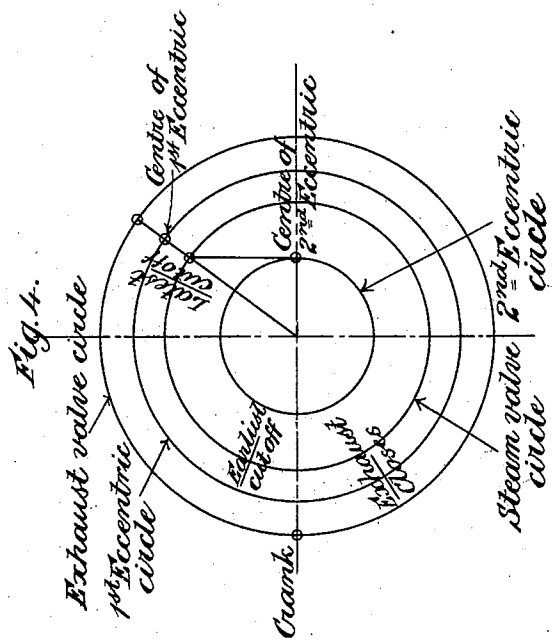
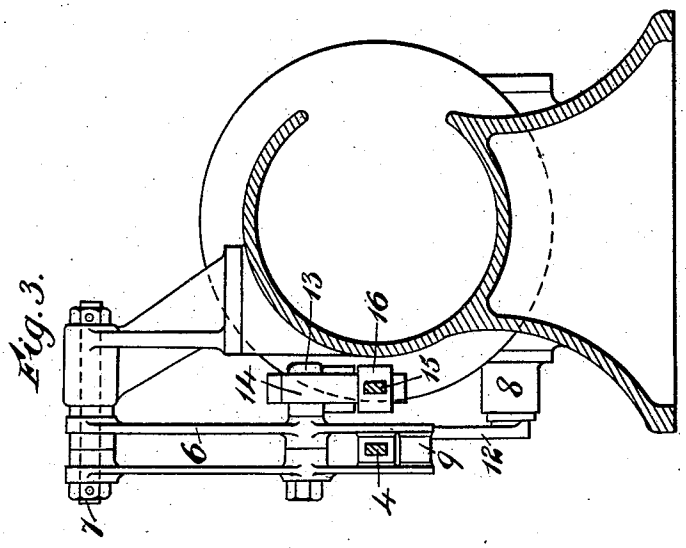



Fig. 3.




Witnesses.

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(No Model.)

3 Sheets—Sheet 3.

# R. M. BAILY, Jr.

## VALVE GEAR.

No. 386,284. Patented July 17, 1888.

Fig. 5.

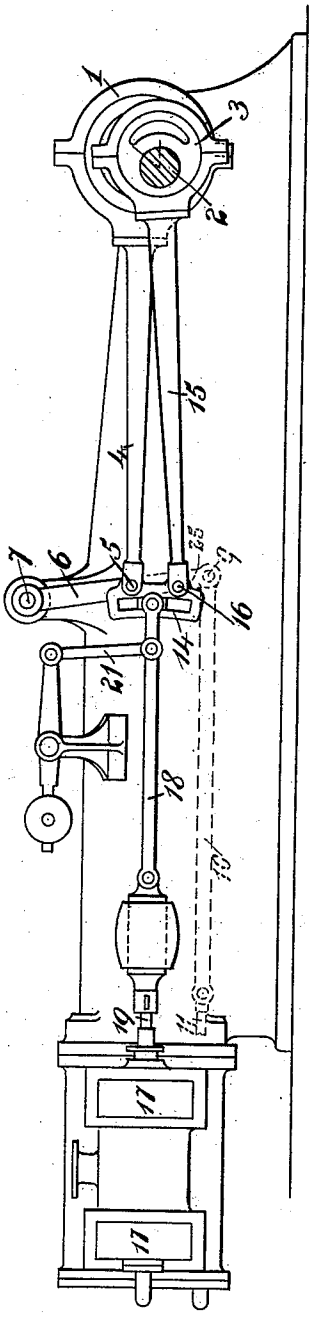
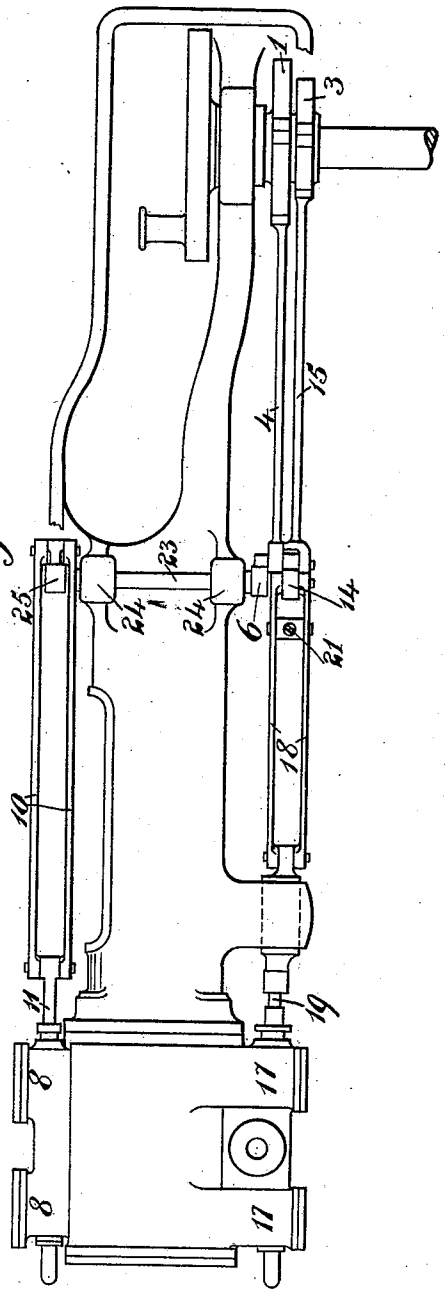



Fig. 6.




Witnesses.

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# UNITED STATES PATENT OFFICE.

ROBERT MAJOR BAILY, JR., OF PADDINGTON, COUNTY OF MIDDLESEX, ENGLAND.

## VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 386,284, dated July 17, 1888.

Application filed September 29, 1886. Serial No. 214,839. (No model.) Patented in England November 17, 1885, No. 14,059, and in Canada October 30, 1886, No. 25,298.

*To all whom it may concern:*

Be it known that I, ROBERT MAJOR BAILY, Jr., a subject of the Queen of Great Britain and Ireland, residing at Paddington, in the county of Middlesex, Kingdom of Great Britain and Ireland, have invented Improvements in Valve-Gear for Steam and other Engines, (part of which has been patented in England, dated November 17, 1885, No. 14,059,) of which the following is a specification.

This invention relates to valve-gear for engines in which separate valves are provided for admission and exhaust, as in engines of the Corliss type and of the Allen-Porter type, and has for its object the variation of the point of cut-off independently of the points of release and compression of the exhaust.

Referring to the accompanying drawings, Figure 1 is a side elevation showing part of a horizontal engine with four valves of the Corliss type with valve-gear according to my invention applied thereto. Fig. 2 is a corresponding part plan of the same. Fig. 3 is a section on the line X X, looking toward the cylinder. Fig. 4 is a diagram for setting the eccentrics for the said engine and valve gear. Fig. 5 shows in side elevation so much of an engine of the Allen-Porter type as is necessary to illustrate the application of my invention to such an engine. Fig. 6 is a plan of the same.

Referring to Figs. 1 to 3, the eccentric 1 is keyed on the crank-shaft 2 with the same angle of advance as if it operated a non-adjustable slide of the usual type so arranged as to give the latest cut-off required. The eccentric 3 is keyed on the crank-shaft directly opposite the crank-pin, and its throw or stroke is equal to twice the linear advance of the steam-valves. The eccentric 1 is, by means of its rod 4, connected at 5 to a swinging arm or lever, 6, pivoted at 7, and operates the exhaust-valves at 8 8 by means of the pin 9, the rods 10 and 11, and arms 12, as shown. It also, by means of a pin, 13, operates one end of a slot-link, 14. It is the upper end of the link 14 which is thus operated full gear, the motion being less but in the same time as the exhaust-valves. The other (the lower) end of the slot-link is operated by the eccentric 3, whose rod 15 is attached to it by a pin at 16. This eccentric 3 is the expansion-eccentric. It is set forward of eccentric 1, and is properly adjusted to open the steam-valves at the proper time and close them easily.

17 17 are the separate steam or admission valves. They are worked from the link 14 by means of a sliding block working therein, rods 18 and 19, and lever-arms 20, as shown. It will be seen that according to the position of the sliding block in the slot-link 14 with respect to the points 13 and 16, where it receives its motion from the eccentrics 1 and 3, respectively, the position of the steam or admission valves 17 will vary, and the cut-off be earlier or later as the block approaches 16 or 13, respectively. When the motion of the admission-valves corresponds with that of the point 13, the latest cut-off is obtained, or, in other words, the steam-valves are worked full gear, and when it corresponds with the motion of the point 16 lead opening only is obtained. The movement of the exhaust-valves at 8 8 remains the same for all points of cut-off.

The position of the block in the slot-link 14 may be varied and controlled by hand, or by the governor directly, or by a cataract-cylinder operated by the governor.

21 is a lifting rod or link for shifting the sliding block in the slot-link 14. It should have its point of attachment 22 on the same side of the motion as the pivot 7 of the swinging lever 6, and its length must be so adjusted as to neutralize the disturbance of the motion of the slot-link 14 caused by the angular movement of arm or lever 6. The point 16 in the slot-link 14 need not necessarily be operated by an eccentric, as shown; but, where more convenient, it can be worked from some other moving part of the engine, care being taken that its motion shall always equal twice the linear advance of the admission-valves and be opposite in direction to that of the piston.

The diagram Fig. 4, which will be readily understood by a competent mechanic accustomed to valve-setting, illustrates the arrangement relatively to one another of the eccentrics, crank, and valves. It is not deemed

necessary to insert figures or letters of reference here, because the different parts are described on the diagram itself.

Referring to Figs. 5 and 6, the eccentric 1 is keyed on the crank-shaft 2 with the same angle of advance as if it operated a non-adjustable slide of the usual type so arranged as to give the latest cut-off required. The eccentric 3 is keyed on the crank-shaft directly opposite the crank-pin, and its throw or stroke is equal to twice the linear advance of the steam-valves. The eccentric 1 is, by means of its rod 4, connected at 5 to a swinging arm or lever, 6. This arm or lever is fast on one end of a rock-shaft, 23, working in bearings 24. On the other end of this rock-shaft is an arm, 25, to the lower end of which is secured by a pin, 9, a double rod, 10, through which and the rod 11 are worked the exhaust-valves at 8 8. The eccentric 3 works the lower end of the slot-link 14 by means of its rod 15, attached to the link by the pin at 16. There is a block in the link, which is connected by rods 18 and 19 with the steam or admission valves at 17. 21 is the lifting rod or link for shifting the sliding block in the slot-link 14.

I have in another application for United States Patent bearing even date of filing herewith, and numbered 214,840, set forth a link slotted to receive a shifting block connected to the valve, one end being actuated by an eccentric and the other being worked with different time and having a motion greater than that of the valve when adjusted for its latest cut-off. Such I do not claim in this application.

What I claim is—

1. In an engine having separate admission and exhaust valves, a pivoted lever, 6, connected at its free end to said exhaust-valves, means for imparting motion to said lever, a link connected near its full gear end to said lever intermediately of the ends of the latter, whereby that end of the link has a movement similar to that of the exhaust-valves, but less, the other end of said link being connected to an eccentric which imparts a motion opposite to that of the piston and equal to twice the linear advance of the admission-valves corresponding to the lead opening only.

2. In an engine having separate admission and exhaust valves, a link, 14, a block capable of sliding in said link, connection from said block to admission-valves, means for varying the position of the block in said link, a pivoted arm or lever, 6, connected to said link, and means for imparting motion thereto, combined and arranged as shown, so that the part of said link attached to said arm or lever has a movement similar to that of the exhaust-valves, but of smaller amplitude, corresponding to latest cut-off, while the other end of said link has a movement opposite in direction to that of the piston and equal to twice the linear advance of the admission-valves corresponding to lead opening only, substantially as hereinbefore described, for the purpose specified.

3. In an engine having separate admission and exhaust valves, the combination, with said valves, of a link, 14, a block capable of sliding therein, connection from said block to the admission-valves, means for varying the position of the block in said link, a pivoted arm or lever, 6, connected to said link 14 at 13, and connected at 9 to rods 10 and 11 for actuating the exhaust-valves, an eccentric, 1, on the crank-shaft connected to the said arm or lever 6, and means for imparting to that end of the link not connected to said arm or lever 6 movement opposite in direction to that of the piston and equal to twice the linear advance of the admission-valves, substantially as hereinbefore described, for the purpose set forth.

4. In an engine having separate admission and exhaust valves, the combination, with said valves and eccentrics 1 and 3 on the engine-shaft 2, of an arm or lever, 6, working on a pivot or joint, 7, rod 4, operated by eccentric 1 and connected at 5 to said arm or lever 6, a slot-link, 14, connected at 13 to said arm or lever, rods 18 and 19, connected to the admission-valves, lifting-rod 21, a rod, 15, worked by eccentric 3 and connected at 16 to link 14, and rod 10, connected at 9 to the arm or lever 6 and to the exhaust-valves, all substantially as described and shown, for the purpose specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ROBERT MAJOR BAILY, JR.

Witnesses:
F. J. BROUGHAM,
HENRY A. BROUGHAM,
*Both of* 46 *Lincoln's Inn Fields, London, W. C.*