

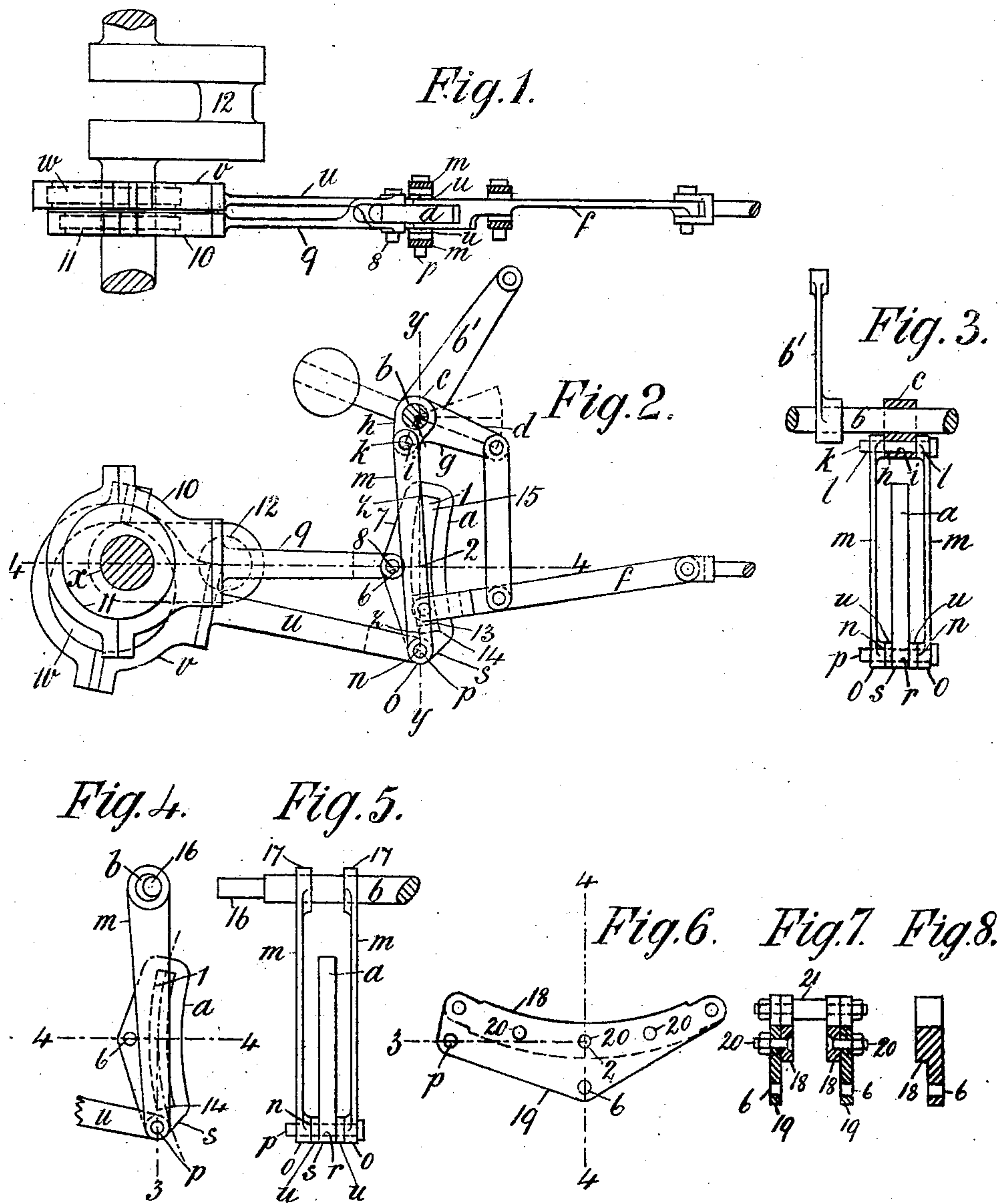
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VALVE GEAR.

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Witnesses.

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HORACE SANDERSON, OF BEN RHYDDING, RUPERT JOHN ISAACSON, OF ILKLEY, AND HENRY ST. JOHN SANDERSON, OF BEN RHYDDING, ENGLAND.

VALVE-GEAR.

No. 915,224.

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To all whom it may concern:

Be it known that we, HORACE SANDERSON, RUPERT JOHN ISAACSON, and HENRY ST. JOHN SANDERSON, subjects of the King of Great Britain and Ireland, residing, respectively, at Ben Rhydding, Ilkley, and Ben Rhydding, in the county of York, England, have invented Improvements in Valve-Gears for Steam and other Fluid-Pressure Engines, of which the following is a specification.

This invention has reference to improvements in valve gears for steam and other fluid pressure engines and more particularly to valve gears of locomotive engines.

It is desirable to so operate the valve of a steam engine that the valve shall move quickly to fully open the admission port at an early point of the stroke of the piston, remain open for a considerable period and close quickly. It is also desirable that the valve shall be operated to open and close the steam ports in the same manner and at the same points of the stroke of the piston at both ends of the cylinder, and, particularly in the case of engines which are reversed for considerable periods, that the ports shall be opened and closed at the same points of the piston strokes whichever way the engine be running. Furthermore, in locomotive engines having inside cylinders, owing to the limited space between the engine frames, it is necessary that the gear be such that it can be made correspondingly narrow.

The gear forming the subject of this application has been designed with these points in view and is thought to more nearly meet these requirements than gears heretofore constructed.

According to this invention, a slotted link in which is a movable die connected to the valve rod, is actuated by means of two eccentrics, the rods of which are connected to the slotted link respectively at one end, or thereabout, and at a point more remote from that end, say about the middle. The link is supported by an oscillatory arm which embraces the connecting rod pivot at or near the end of the link (or a pivot coaxial therewith) and extends across the link to a pivotal point of support, the slotted link thus mounted being capable of being oscillated about either of the two points by the two eccentrics.

The point of support of the oscillatory arm, especially in the case of engines which are frequently reversed, may be adapted to

be shifted during reversal in such manner as to maintain the points of admission and cut off practically or nearly constant at both ends of the cylinder for forward and backward running of the engine. The point of support of such oscillatory arm may be outside the center of the main reversing shaft so as to be circumferentially adjusted thereabout, such radial adjustment being governed by the movement of the reversing lever while altering the position of the die and end of valve rod from one end of the slot in the link to the other end for reversing purposes, and intermediate positions therein.

We will now proceed to describe the invention by the aid of the accompanying illustrative drawings, in which—

Figures 1 and 2 are respectively a plan view and a side elevation of one construction of valve gear according to this invention suitable for a locomotive engine. Fig. 3 is a sectional end view showing the method of suspending the slotted link. Figs. 4 and 5 are respectively a side elevation and an end view showing another method of suspending the said link. Figs. 6 to 8 are detail views hereinafter referred to.

In one construction of valve gear according to this invention suitable for a locomotive engine, the center of the link *a* is placed, if anything, forward of the center of the reversing shaft *b* which is arranged transversely above it and has secured to it the main lever *b*¹ the movement of which causes reversal. The boss *c* of the reversing lever *d*, which is linked to the valve rod *f*, surrounds such shaft *b*, and is formed on its lower side *g*, at right angles to the said lever arm *d*, with a projecting lug *h*, which may be the same thickness as the boss and has, at a certain distance from the center of the lever *d*, a bearing *i* for a stud *k* on the projecting ends *l* and *l*¹ of which are mounted a pair of oscillating arms *m* having bearings *n* in their lower ends *o* to receive a joint pin *p* which also passes through a suitable bearing *r* in the lower ends *s* of the link *a* and forms the joint pin for one end of an eccentric rod *u*, the strap *v* of which surrounds an eccentric *w* that is secured on the crank shaft *x* and is adapted to give sufficient motion to the link *a* to operate the valve in either direction to fully open the admission ports. The position of this bearing *r* in the lower end *s* of the link *a* may conveniently be on a straight line

$y-y$ passing through or practically through the outer corners z of the elongated slot 1 formed in the link a , and at a suitable distance from the center 2 of the link a ; or it may as shown in Fig. 6 be on a horizontal line 3 drawn at right angles to a vertical line 4 passing through the center 2 of the length of the link a , the line 3 passing through the junction of the line 4 and the curved center line of the slot 1 of the link a . Another bearing 6 is formed in the back portion 7 of the link a at a certain distance from the center 2 of the radial slot 1, also on the horizontal center line 4 and in this bearing 6 is placed the joint pin 8 of an eccentric rod 9, the strap 10 of which surrounds an eccentric 11 that is secured on the crank-shaft x at 180° to the crank 12 and has a throw equal to the lap and lead, so that the valve will receive sufficient movement through the link a , to open either port to lead. When the crank 12 is on the dead center the first eccentric w is fixed in the requisite angular position with the crank 12 and the second eccentric 11.

When the engine is running in the forward direction with the reversing lever or arm d in its lowest position, the valve rod die 13, being in the lower end 14 of the slot 1, the link a will be in the vertical position, the center of the projecting lug h on the reversing lever d behind the center of the reversing shaft b , and the back port open to lead. The action of the first named eccentric w then will move the bearing r in the lower end s of the link a forward and oscillate the link a on the stud 8 of the second named eccentric rod 9 and fully open the port; the combined action of both eccentrics w and 11 acting on the link a then causes the valve to dwell for a certain time, and then to close the back port, when the second eccentric 11 so oscillates the link a on the pin p of the first eccentric w , as to open the front port to lead, when similar movements of the link a and valve take place.

The movement of the support of the oscillatory arms m into the position behind the center of the reversing shaft b (Fig. 2), slightly lifts the link a owing to the circumferential movement of the stud k about the reversing shaft b , imparts such an angular movement to the link a that the lower end s thereof is moved in a forward direction, with the result that the combined action of the two eccentrics w and 11 on the link a gives to the valve a properly balanced movement so that it cannot overrun the port at the back end of its movement. When the reversing lever or arm d is moved to the other end of its movement and the die 13 of the valve rod f placed in the upper end 15 of the slot 1, the support k of the oscillatory arms m is moved in front of the center of the reversing shaft b , which puts the said arms m nearly in a vertical position and produces an angular move-

ment of the lower end s of the link a in the reverse direction, and insures a properly balanced movement of the valve in this case also.

Other methods of altering the position of the support of the oscillatory arms may be adopted, such as making the ends 16 of the reversing shaft b eccentric with the body part, as shown in Figs. 4 and 5, such ends being mounted in bearings on the engine frame; the ends 17 of the oscillatory arms m then surround the reversing shaft b .

In the case of locomotive engines with outside cylinders, one of the eccentrics may be placed on the outer end of the crank shaft x , or instead of an eccentric, a return crank may be used. Instead of connecting the first named eccentric rod u to the joint pin p in the lower end s of the link a it may be connected to the oscillatory arms m in any convenient position above the said pin p without altering the movement of the link a , the throw of the eccentric being altered to suit the required movement of the arms.

When curved unslotted bars are used instead of the slotted link, as in the case of marine engines, as shown in Figs. 6 and 7 the bars 18 may be secured to suitable side plates 19 by bolts 20, and spaced apart by pillar bolts 21, such side plates 19 being provided with the necessary bearings for the connections of the eccentrics and oscillatory arms m as in the case of the slotted link a . Or such plates may be made in one piece with the bars 18 as shown in Fig. 8.

When the reversing lever is made in one piece with the reversing shaft a suitable lug or boss is or may be formed thereon to receive the stud or support of the oscillatory arms instead of the projecting lug being formed on the reversing lever d .

In engines which are seldom reversed, the support of the oscillatory arms may be fixed, for instance the reversing shaft may extend through their upper ends, but such an arrangement is not so advantageous as regards efficiency, when the engine is reversed, and cheapness of construction.

Although an arrangement in which the reversing lever is above the link and the oscillatory arms are pendulous has been described it is to be understood that the gear may be otherwise arranged, for instance it might be turned over so that the reversing shaft would be below instead of above.

What we claim is:—

1. In a valve-gear for fluid-pressure engines embodying a valve reciprocated by two eccentrics one of which has a throw corresponding to the lap and lead of the valve and the other a throw corresponding to the full opening of the valve, an oscillating link to which the rods of said eccentrics are respectively connected at different points, the connection of the eccentric rod giving the full opening of the valve being at the lower end

of the link, a reversing rock-shaft journaled above the link and provided with a reversing lever and means connecting the same to the shifting portion of the valve-rod, a supporting link pivotally connected at its lower end to the lower end of the oscillating link on the same stud as the end of the connecting rod of the eccentric which gives the full opening to the valve and means pivotally connecting its upper end to the reversing lever, the axis of this pivot being arranged horizontally underneath the reversing shaft so as to be shifted alternately forward of and behind the center of the rock-shaft when the engine is reversed by rocking the reversing shaft.

2. In a valve-gear for fluid-pressure engines embodying a valve reciprocated by two eccentrics one of which has a throw corresponding to the lap and lead of the valve and the other a throw corresponding to the full opening of the valve, an oscillating link to which the rods of said eccentrics are respectively connected at different points, the connection of the eccentric rod giving the full opening of the valve being at the lower end of

the link, a reversing rock-shaft journaled above the link and provided with a reversing lever and means connecting the same to the shifting portion of the valve-rod, a supporting link pivotally connected at its lower end to the lower end of the oscillating link on the same stud as the end of the connecting rod of the eccentric which gives the full opening to the valve, and means pivotally connecting its upper end to the reversing lever, said means embodying a depending arm or lug carrying a pivot stud whose axis is below and parallel with the axis of the reversing shaft, this pivot being so located that it shifts to points forward of and behind the axis of the reversing shaft when the engine is reversed.

Signed at Leeds, England, this fourth day of March 1908.

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