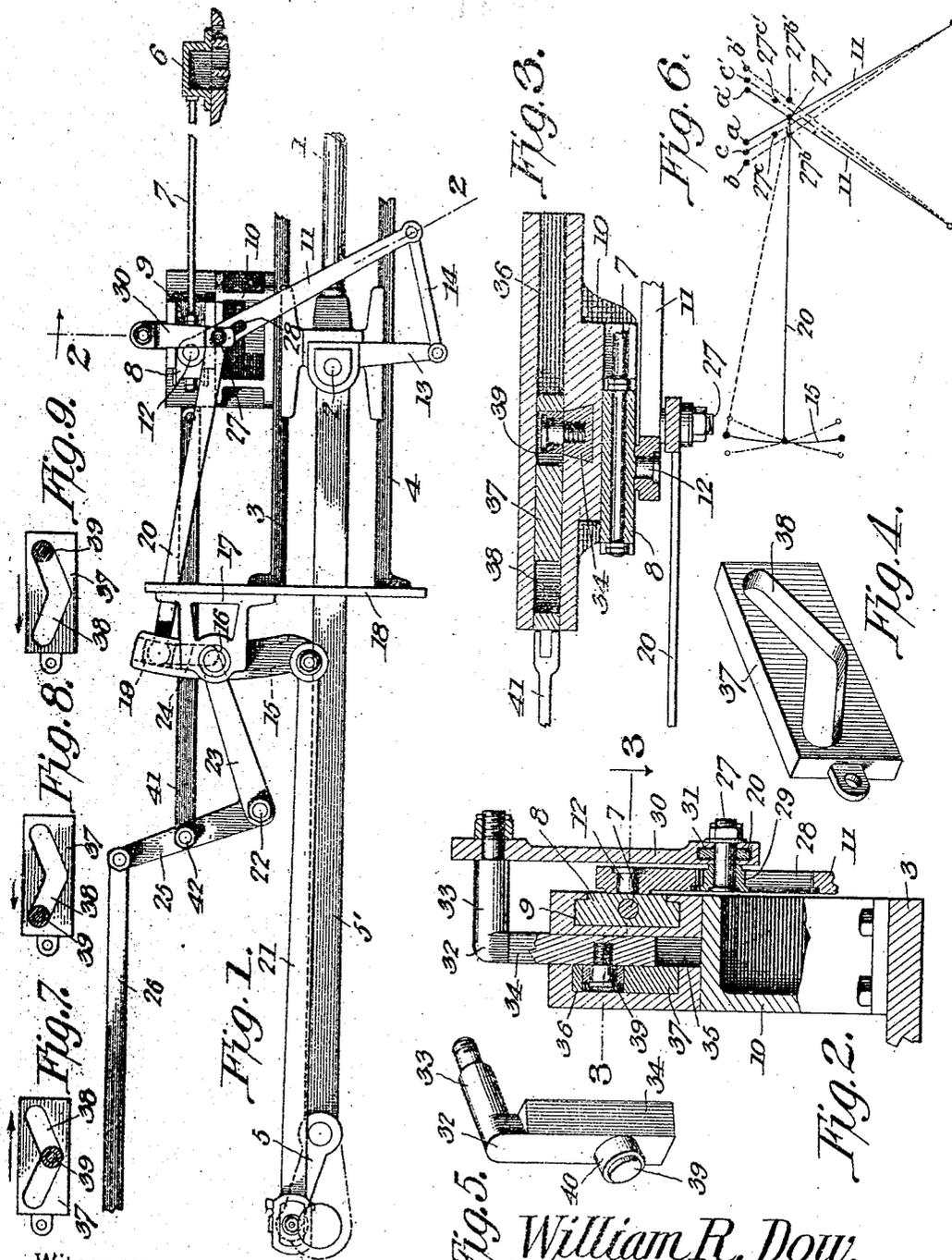


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W. R. DOW.
VALVE GEAR.

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VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 786,432, dated April 4, 1905.

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To all whom it may concern:

Be it known that I, WILLIAM ROBERT DOW, a citizen of the United States, residing at Boulder Creek, in the county of Santa Cruz and State of California, have invented a new and useful Valve-Gear, of which the following is a specification.

This invention relates to valve-gears particularly adapted for actuating the slide-valve of a locomotive-cylinder, and is designed to insure the proper lead of the valve in full gear as well as in mid-gear.

The present invention has been especially designed to improve the Walschaert link-motion, wherein the shifting of the fulcrum of the combination-lever in the direction of the movement of the slide-valve to vary the lead of the valve produces too great a lead in full gear, and therefore it is an important object of the present invention to offset the surplus lead of the valve occasioned by shifting the fulcrum of the combination-lever by the radius-rod, so as to obtain the desired increase in lead in full gear and also obtain the proper lead in mid-gear. To accomplish this object, it is proposed to shift the fulcrum of the combination-lever at right angles to the direction of the shift occasioned by the radius-rod in such a manner as to decrease the throw of the combination-lever to a predetermined extent and to counteract or offset the usual increase in lead occasioned by the shifting of the fulcrum of the combination-lever in the direction of the movement of the slide-valve.

With these and other objects in view the present invention consists in the combination and arrangement of parts, as will be hereinafter more fully described, shown in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that changes in the form, proportion, size, and minor details may be made within the scope of the claims without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings, Figure 1 is a side elevation of the Walschaert link-motion having the improvements of the present invention included therein. Fig. 2 is an enlarged detail cross-sectional view on the line

2 2 of Fig. 1. Fig. 3 is a cross-sectional view on the line 3 3 of Fig. 2. Fig. 4 is a detail perspective view of the shiftable cam for shifting the position of the fulcrum of the combination-lever. Fig. 5 is a detail perspective view of the bracket member which is shifted by the cam. Fig. 6 is a diagrammatic view illustrating the principle involved in the present invention. Figs. 7, 8, and 9 are detail views illustrating different positions of the shiftable cam for shifting the fulcrum of the combination-lever.

Like characters of reference designate corresponding parts in each and every figure of the drawings.

To illustrate the application and operation of the present improvement, the essential parts of the Walschaert link-motion have been shown in the accompanying drawings, wherein 1 designates a piston-rod having a cross-head 2 working between the upper and lower guide or frame bars 3 and 4. In rear of the cross-head is the usual crank-arm 5, which is driven from the cross-head by the usual connecting-rod 5'. The usual slide-valve is shown at 6 and is provided with an ordinary valve rod or stem 7, having its rear end provided with a slide-block 8, working in the channeled upper portion 9 of the bracket 10, supported upon the top of the upper frame-bar 3 in substantially the usual manner. The combination-lever 11 has its upper end pivotally connected to the slide 8 by a pin 12, projected laterally from the slide, while the lower end of this lever is operatively connected to the cross-head 2 by a pendent arm 13, rigid with the cross-head and a link 14, pivotally connected at its opposite ends to the lower ends of the arm 13 and the combination-lever, respectively. In rear of the combination-lever is the usual upstanding link 15, having an intermediate fixed pivot 16, carried by a bearing or bracket 17, which is in turn supported upon a standard 18, rising from the combined frame and guide bars 3 and 4. This link carries the usual saddle-block 19, to which is connected the radius-rod 20, the forward end of the latter being connected to the combination-lever in accordance with the present invention, as

will be hereinafter described. For rocking the link 15 there is the usual eccentric rod 21. The saddle-block 19 is shifted upon the link 15 in the usual manner by the tumbling-shaft 22, which carries a crank-arm 23, there being a link 24 (shown in dotted lines in Fig. 1) extending between the crank-arm 23 and the saddle-block, and the tumbling-shaft is controlled in the usual manner by means of the crank-arm 25, rising from the shaft, and the connecting-rod 26, pivotally connected to the upper end thereof and extending into the cab of the engine and connected to the reversing-lever in the usual manner.

As thus far described the construction is that of the ordinary Walschaert link-motion and operates as follows: The combination-lever 11 is swung upon its fulcrum 27 through its connection with the cross-head of the piston-rod, so as to impart the desired reciprocatory movement to the slide-valve 6. In addition to its swinging movement the combination-lever also has a bodily movement occasioned by the shifting of the fulcrum 27 in the direction of the movement of the valve by the endwise movement of the radius-rod 20, which is connected to the fulcrum 27 and also to the link 15 by means of the saddle-block 19, the link being oscillated upon its pivotal support 16 by means of the eccentric rod 21. If the saddle-block 19 be shifted to a position midway between the end of the link 15, there will be no endwise movement to the radius-rod 20. Hence the fulcrum 27 will remain stationary in mid-gear. Upon shifting the saddle-block to either side of the center of the link 15 for increased speed said link will impart an endwise movement to the radius-rod 20, and therefore the fulcrum 27 will be reciprocated in the direction of the movement of the valve 6 simultaneously with the swinging movement of the combination-lever 11, wherefore the bodily movement imparted to the lever is also imparted to the slide-valve 6 in addition to the movement occasioned by the swinging of the lever, thereby producing a longer path of movement for the valve, which increases the lead thereof. To have the proper lead in mid-gear, the Walschaert arrangement for increasing the lead in full gear produces a longer lead than is essential for the best results, and to overcome this objection I propose to reduce or neutralize the increased lead occasioned by the movement of the fulcrum 27 by shifting the latter vertically or at right angles to the movement of said fulcrum. To obtain this feature, the fulcrum 27 is formed in the nature of a pin and the combination-lever 11 is provided with a longitudinal slot 28 to receive the fulcrum-pin and permit of the latter being slid therein. An antifriction roller or sleeve 29 is carried by that portion of the fulcrum-pin 27 which works in the slot of the combination-lever,

while the other end of the pin projects in front of the lever and loosely pierces the lower end of a link 30, the rear side of the lower end of the link being provided with a slot or opening 31 to receive the forward end of the radius-rod 20, which is pierced by the fulcrum 27, so as to be pivotally connected therewith. The upper end of the link 30 is pivotally hung from an inverted substantially L-shaped bracket 32, the substantially horizontal arm 33 of which loosely pierces the link to pivotally connect the latter thereto, while the upright arm or member 34 of the bracket works vertically in a guideway 35, formed in the upper portion of the stationary bracket 10 and in rear of the valve-slide 8. In rear of the movable bracket the stationary bracket is provided with a substantially horizontal open-ended guideway 36 for the reception of a shiftable cam-block 37, which is provided with a substantially V-shaped slot 38, in which is received a pin or projection 39, carried by the upright arm 54 of the movable bracket and provided with an antifriction-sleeve 40. A rod 41 is pivotally connected to the rear end of the slidable cam 37 and has its rear end pivotally connected to the crank 25 of the tumbling-shaft 22, as at 42, whereby the cam 37 is simultaneously shifted with the shifting of the saddle-block 19 upon the link 15. When in mid-gear, as shown in Fig. 7, the pin or projection 39 of the movable bracket 32 is at the bottom of the slot 38 in the cam-block 37, which is the lowermost position of the pin 39, and consequently the lowermost position of the fulcrum 27 at the lower end of the slot 28 of the combination-lever 11. Upon moving the reversing-lever ahead the shiftable cam 37 will be moved in the direction of the arrow on Fig. 7, whereby the pin 39 will be moved vertically by the rear portion of the lower wall of the slot 38 until it reaches its highest position at the rear end of the slot. As the pin 39 is moved upwardly the bracket 32 and the link 30 will be moved therewith, whereby the fulcrum 27 will also be moved upwardly in the slot 28, which decreases the throw of the combination-lever. It will here be explained that this upward shifting of the fulcrum 27 does not interfere with its reciprocatory movement under the influence of the radius-rod 20, for the reason that the link 30 is pivotally hung from the movable bracket 32, and therefore permits of the necessary reciprocation of the fulcrum 27. When the lever is reversed, the shiftable cam 37 is of course moved in the opposite direction, as indicated by the arrow in Fig. 9, thereby drawing the pin 39 to the bottom of the slot 38 and then elevating the pin in the forward portion of the slot as the lever passes rearwardly beyond mid-gear, the fulcrum 27 of course following the movement of the pin 39.

In explanation of the result attained by

shifting the fulcrum of the combination-lever at substantially right angles to the direction of its reciprocating movement reference will be had to Fig. 6 of the drawings, wherein it will be assumed that the radius-rod 20 is at the center of the link 15, in which position there will be no reciprocation of the fulcrum 27, and therefore the movement of the valve will be determined by the extreme positions a and a' of the upper end of the combination-lever 11, as indicated by the full-line position thereof. When the radius-rod 20 is shifted to either side of the center of the link 15, an endwise movement will be imparted to the radius-rod and the fulcrum 27 will be in turn reciprocated—say, for instance, from the point 27^b to the point $27^{b'}$ —the movement of the valve then corresponding to the distance between the positions b and b' of the upper end of the combination-lever. The movement of the valve through the distance $b b'$ produces too great a lead of the valve; but this is offset by the shifting of the cam 37, which elevates the fulcrum 27 from the lowermost end of the V-shaped slot in the cam, and while the slidable movement of the fulcrum is the same as before, as indicated at 27^c and $27^{c'}$, the fulcrum-pin having been shifted upwardly through the slot in the combination-lever the throw of the lever has been proportionately reduced, as indicated by the points c and c' , thereby reducing the movement of the valve and producing the most effective lead thereof.

From the foregoing description it will be understood that the application of the present invention to the Walschaert gear does not change the principle and operation of the latter in any manner whatsoever, as the swinging link 30 permits of the usual reciprocation of the fulcrum of the combination-lever; but the fulcrum of the combination-lever is shifted longitudinally upon the lever to increase and decrease the throw thereof in such a manner as to neutralize the excess movement of the valve occasioned by the reciprocation of the fulcrum. Moreover, the cam 37 is normally stationary and may be connected directly to the tumbling-shaft for simultaneous shifting with the shifting of the saddle-block to shift the radius-rod.

Having fully described the invention, what is claimed is—

1. In a valve-gear, the combination of a slide-valve and its rod, a piston-rod, a lever connected at opposite ends to the valve-rod and the piston-rod and having an intermediate movable fulcrum, a radius-rod connected to the fulcrum for moving the same, and means to reduce the increased movement of the valve occasioned by the movement of the fulcrum in changing from mid-gear toward full gear.

2. In a valve-gear, the combination of a slide-valve and its rod, a piston-rod, a lever

connected at opposite ends to the valve-rod and the piston-rod and having an intermediate movable fulcrum, a radius-rod connected to the fulcrum for moving the same, and means to shift the fulcrum longitudinally of the lever.

3. In a valve-gear, the combination of a slide-valve and its rod, a piston-rod, a lever connected at opposite ends to the valve-rod and the piston-rod, an intermediate fulcrum for the lever, means to reciprocate the fulcrum and means to shift the fulcrum in the longitudinal direction of the lever.

4. A valve-gear having a lever, means to reciprocate the fulcrum, and means to shift the fulcrum transversely to the direction of its reciprocating movement.

5. A valve-gear having a lever, means to bodily reciprocate the lever in the direction of its swinging movements, and means to shift the fulcrum of the lever longitudinally of the latter.

6. A valve-gear having a lever provided with a longitudinal slot, a fulcrum shiftable in the slot, and means to reciprocate the fulcrum transversely of its shiftable movement.

7. In a valve-gear, the combination of a slide-valve and its rod, a piston-rod, a lever connected at opposite ends to the valve-rod and the piston-rod and provided with an intermediate longitudinal slot, a fulcrum located in the slot, means to shift the fulcrum longitudinally of the slot, and means to reciprocate the fulcrum transversely of its shiftable movement.

8. In a valve-gear, the combination of a slide-valve and its rod, a piston-rod, a lever connected at opposite ends to the valve-rod and the piston-rod, an intermediate fulcrum for the lever, a cam to shift the fulcrum in the longitudinal direction of the lever, and means to reciprocate the fulcrum transversely of its shiftable movement.

9. In a valve-gear, the combination of a slide-valve and its rod, a piston-rod, a combination-lever connected at opposite ends to the valve-rod and the piston-rod, an intermediate fulcrum for the combination-lever, means for reciprocating the fulcrum in the direction of movement of the valve, and means for shifting the fulcrum longitudinally of the combination-lever.

10. In a valve-gear, the combination of a slide-valve and its rod, a piston-rod, a combination-lever connected at opposite ends to the valve-rod and the piston-rod, an intermediate fulcrum for the combination-lever, a link fulcrumed intermediate of its ends, an eccentric rod connected to the link, a radius-rod extending between the link and the fulcrum of the combination-lever, and means to shift the fulcrum longitudinally of the combination-lever.

11. In a valve-gear, the combination of a slide-valve and its rod, a piston-rod, a com-

5 combination-lever connected at opposite ends to the valve-rod and the piston-rod, an intermediate fulcrum for the combination-lever which is shiftable longitudinally thereon, a swinging link supporting the fulcrum, a radius-rod connected to the link, a slidable bracket having the link pivoted thereon, and means to shift the movable bracket and thereby shift the fulcrum.

10 12. In a valve-gear, the combination of a slide-valve and its rod, a piston-rod, a combination-lever connected at opposite ends to the valve-rod and the piston-rod, a fulcrum for the lever which is shiftable longitudinally thereon, a swinging link supporting the fulcrum, a movable bracket to which the link is pivotally connected, and a shiftable member having an inclined slot, the movable bracket having a projection entering the slot to move the bracket under the influence of the inclined slot.

15 13. In a valve-gear, the combination with a slide-valve and its rod, a piston-rod, a combination-lever connected at opposite ends to the valve-rod and the piston-rod and provided with a longitudinal slot, a fulcrum-pin slidable in the slot of the lever and projected at one side thereof, a swinging link pivotally connected to the projected portion of the fulcrum, a substantially L-shaped movable bracket having the link pivotally swung from one arm thereof, the opposite arm being provided with a lateral projection, and a shiftable member having an inclined slot receiving the projection of the bracket to shift the latter by movement of the slidable member and thereby shift the fulcrum in the slot of the combination-lever.

20 14. In a valve-gear, the combination with a slide-valve and its rod, a piston-rod, a combination-lever connected at opposite ends to the valve-rod and the piston-rod, a fulcrum adjustable longitudinally upon the lever, an oscillating link, a radius-rod extending between the link and the fulcrum to reciprocate the latter transversely of the lever, a

shiftable bracket, a link pivotally carried by the bracket and connected to the fulcrum of the lever to support the same, a shiftable cam to move the bracket, a tumbling-shaft, means connecting the tumbling-shaft and the radius-rod to shift the latter upon the oscillating link, and a connection between the tumbling-shaft and the cam to simultaneously shift the latter with the shifting of the radius-rod.

15. In a valve-gear, the combination with a slide-valve and its rod and a piston-rod, of a stationary bracket having a pair of guideways extending in the direction of movement of the valve and another guideway located between and at substantially right angles to the first-mentioned guideways, a bracket movable longitudinally in the latter guideway and having an arm overhanging the top of the stationary bracket, a slide having a substantially V-shaped slot working in one of the pair of guideways and another slide working in the other guideway and connected to the valve-rod, a swinging link hung from the overhanging member of the movable bracket, a combination-lever connected to the slide of the valve-rod and to the piston-rod and provided with a longitudinal slot, a fulcrum carried by the swinging link and working in the slot of the lever, an oscillating link, a radius-rod extending from the oscillating link to the swinging link, the movable bracket having a projection working in the slot of the slotted slide, a tumbling shaft, means connecting the tumbling-shaft with the radius-rod to shift the latter upon the oscillating link, and a connection between the slotted slide and the tumbling-shaft.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

WILLIAM ROBERT DOW.

Witnesses:

W. B. PEERY,

M. BLABON.