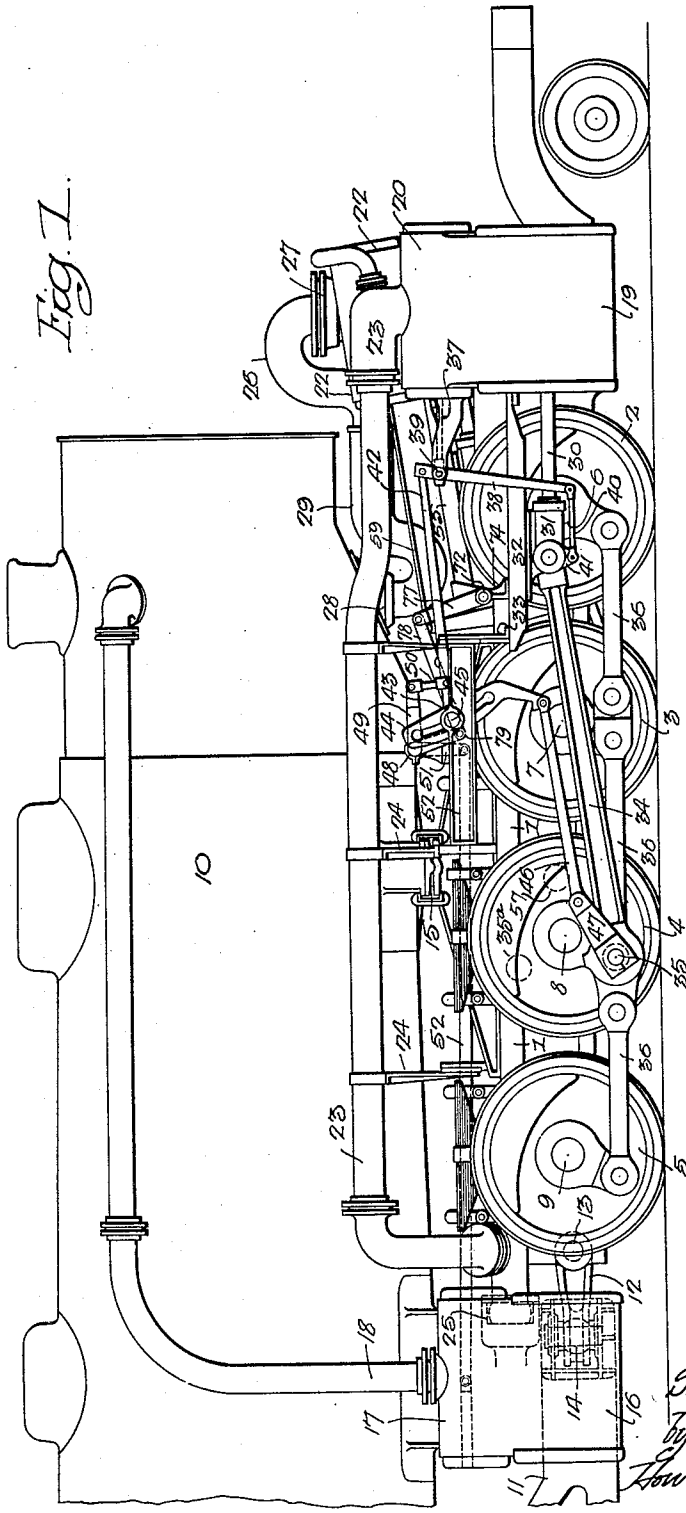
April 22, 1930. S. M. VAUCLAIN 1,755,974

LOCOMOTIVE

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Fig. 1.



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Fig. 2.

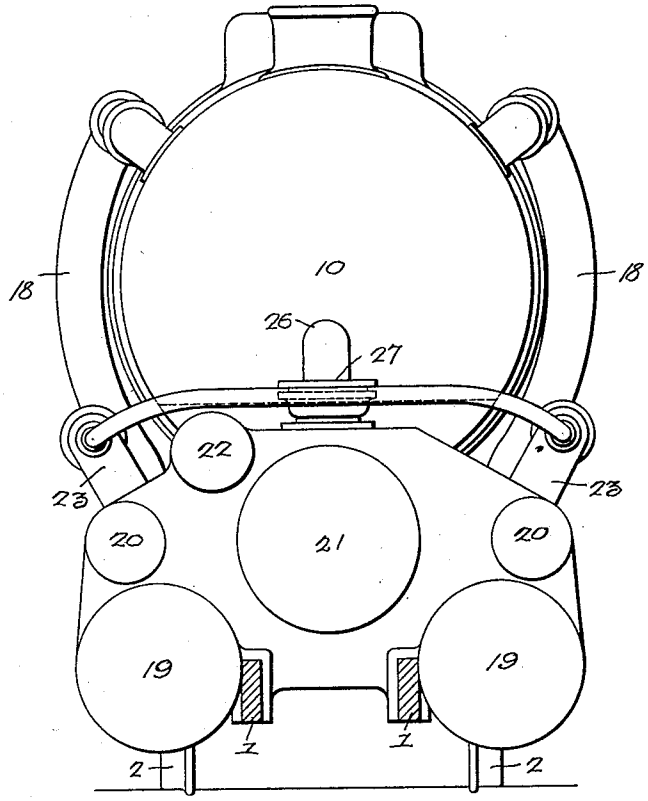
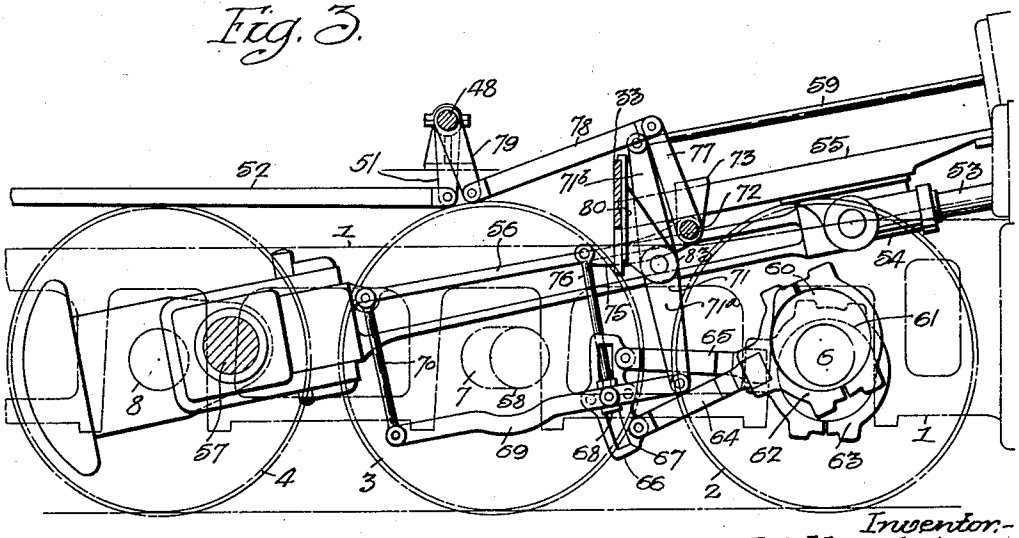


Fig. 3.



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Fig. 4.

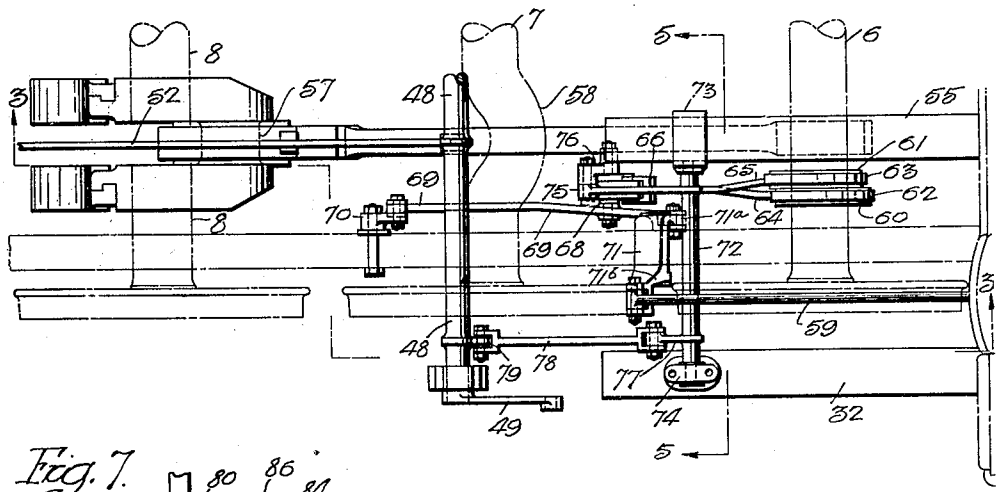


Fig. 7.

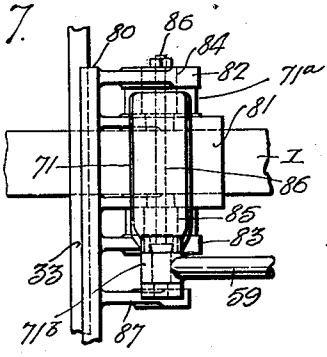


Fig. 5.

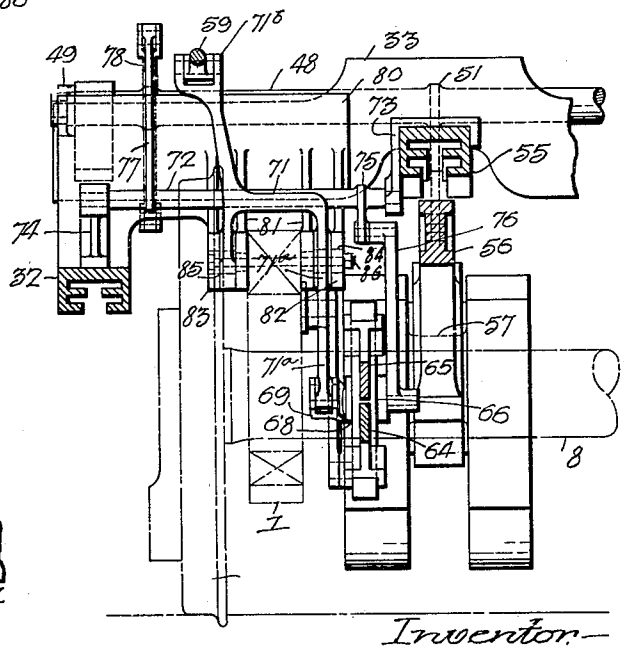
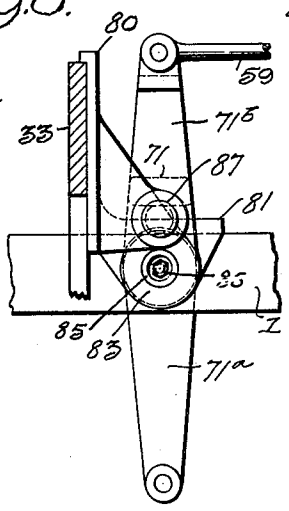


Fig. 6.



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LOCOMOTIVE

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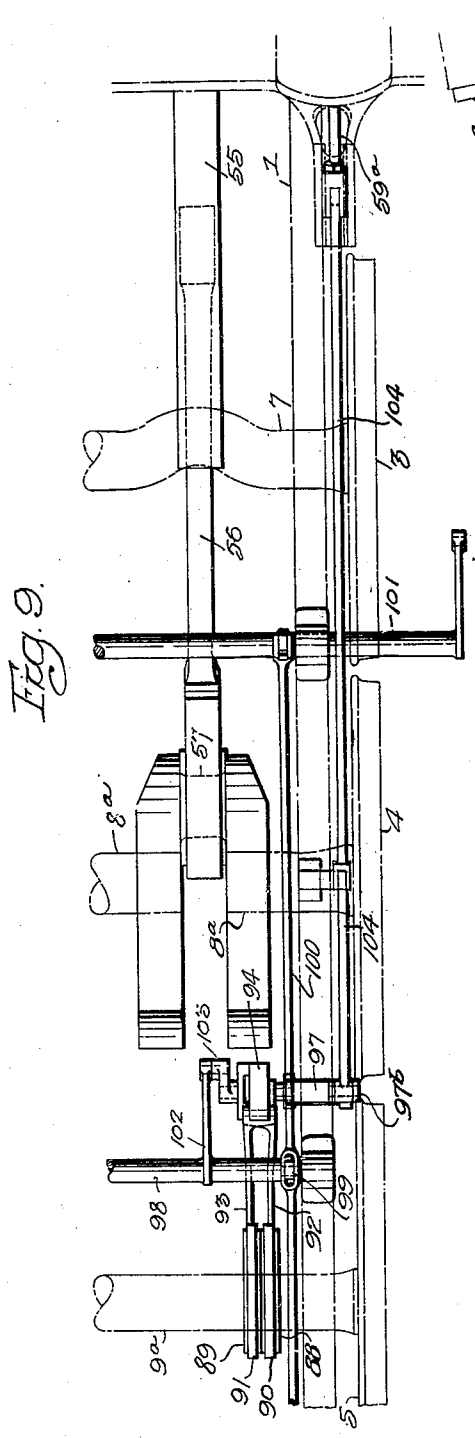


Fig. 9.

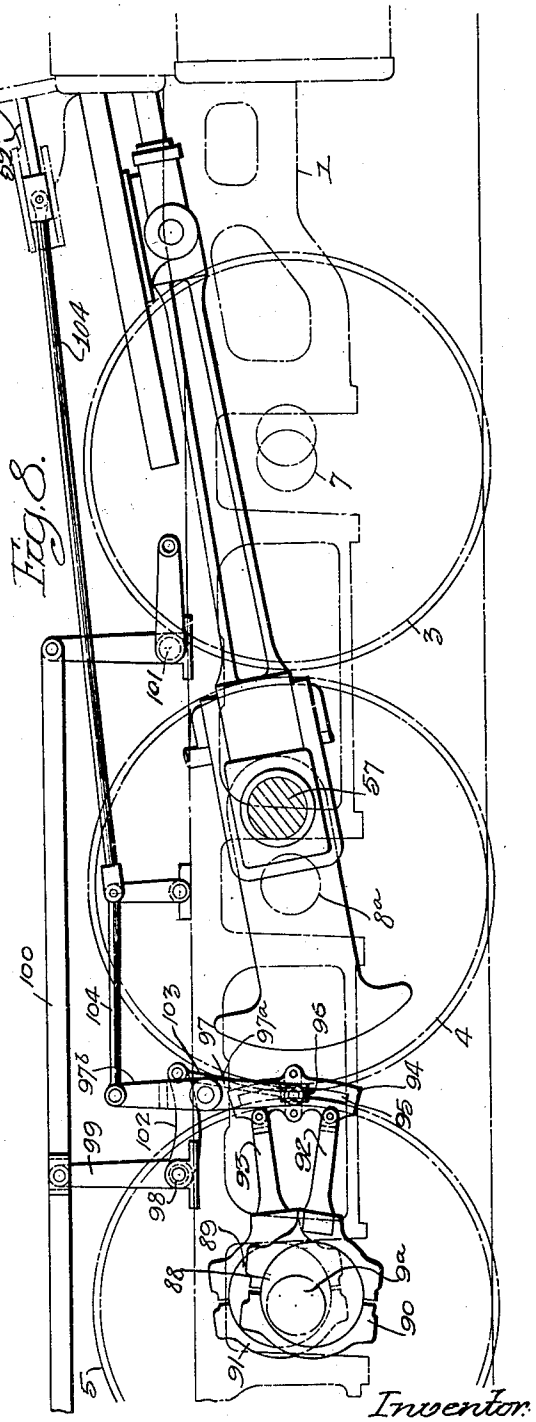


Fig. 8.

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UNITED STATES PATENT OFFICE

SAMUEL M. VAUCLAIN, OF ROSEMONT, PENNSYLVANIA, ASSIGNOR TO THE BALDWIN LOCOMOTIVE WORKS, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

LOCOMOTIVE

Application filed January 23, 1926. Serial No. 83,280.

The invention relates particularly to locomotives of the three cylinder type, that is to locomotives having a third cylinder located centrally between the two forward outer cylinders. The three cylinder unit may be used alone, or it may be combined in a locomotive of the Mallet type, with two rear cylinders to form a five cylinder locomotive.

The principal object of the invention is to provide an improved combination of the valve gear mechanism for operating the valves of the three cylinder or forward unit. In accordance with the invention, I use a valve gear of the Stephenson type for operating the valve of the third cylinder in combination with valve gears of the Walschaert or other types for operating the valves of the outer cylinders.

Another object of the invention is to provide various improved details of construction and mounting for the Stephenson valve gear.

Still further objects of the invention will be apparent from the following specification and claims.

It is to be understood that the accompanying drawings showing the invention are for illustrative purposes only and are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawings:

Fig. 1 is a side view of the front part of a locomotive embodying the invention.

Fig. 2 is a front view with certain parts omitted, this view showing the relation between the cylinders and valve chests.

Fig. 3 is a schematic side view showing the Stephenson valve gear and associated parts.

Fig. 4 is a schematic plan view of the parts shown in Fig. 3.

Fig. 5 is an enlarged transverse vertical sectional view taken along the line 5—5 of Fig. 4.

Figs. 6 and 7 are side and plan detailed views, respectively, showing the rocker arm forming a part of the operating mechanism for the Stephenson valve gear.

Figs. 8 and 9 are schematic views somewhat similar respectively to Figs. 3 and 4, but showing an alternate embodiment of the invention.

Referring to the drawings, it will be seen that I have illustrated the invention as applied to a five cylinder Mallet locomotive. As illustrated the front frame 1 of the locomotive is supported in the usual way on drive wheels, four pairs 2, 3, 4 and 5 of such wheels being illustrated. These pairs of wheels are provided respectively with axles 6, 7, 8 and 9.

The boiler is indicated by 10, this boiler being directly connected with and partly supported by the rear section of the main frame, a part of which is indicated at 11. This rear section of the main frame is supported in the usual way on suitable drive wheels (not shown). The two frames 1 and 11 are connected by means of a link 12 having a horizontal pivotal connection at 13 with the front frame, and a vertical pivotal connection at 14 with the rear frame. The front part of the boiler has a sliding bearing 15 on the front frame 1. Thus the front frame is enabled to turn with respect to the rear frame in accordance with curvatures of the track, and, at the same time, the front frame serves to carry its proportionate weight of the boiler.

The cylinders for the rear unit of the locomotive are represented by 16. Theses cylinders may be secured directly to the boiler or to the rear frame. They are provided with valve chests 17 to which steam is supplied from the boiler through pipes 18. Associated with the cylinders 16 are the usual connecting rods, connecting links, valve gears and the like which are not shown as they do not of themselves constitute any part of the present invention.

The two outer cylinders for the front unit are represented at 19, 19, these being provided with valve chests 20, 20. The third cylinder for the front unit is shown at 21, being located at the center of the locomotive. This cylinder is provided with a valve chest 22 located at one side of the center. It will be noted that, while the cylinders 19, 19 with their valve chests are substantially horizontal, the cylinder 21 with its valve chest is inclined downward toward the rear.

The three cylinders 19, 19 and 21 are preferably low pressure cylinders receiving steam

discharged from the high pressure cylinders 16. For conducting the steam from the high pressure cylinders to the low pressure cylinders receiver pipes 23 are provided, these pipes being carried on the front frame by means of brackets 24, 24. These pipes receive the steam after it has expanded in the cylinders 16—16, and they are connected by means of flexible ball joints 25 which permit the receiver pipes 23 to move with the frame 1 and the cylinders 19, 19, and relatively to the boiler 10. It is to be noted that these receiver pipes 23 are not located in the position usually occupied by such pipes which is between the side members of the frame 1. In the present case, by reason of the use of a cranked axle for the third cylinder as will be presently explained, the conventional location of the pipes cannot be used.

The exhaust from the three cylinders 19, 19 and 21 is through the exhaust pipe 26. Inasmuch as the cylinders and their steam chests are carried by the relatively movable front frame, and inasmuch as the exhaust must discharge into the front of the boiler structure, the said exhaust pipe 26 is provided with flexible ball joints at 27 and 28, and is also provided with a telescopic connection or slip joint at 29.

Each of the front cylinder 19, 19 is provided with the usual piston rod 30 and cross-head 31. The cross-head 31 travels along the guide 32, which is supported by means of the transverse supporting member 33 carried by the frame 1. A connecting rod 34 extends from the cross-head to a crank pin 35 on one of the drive wheels, and when there are four drive wheels on each side, as shown, the crank pin will ordinarily be on the third wheel from the front. The usual links 36 are provided for connecting the several drive wheels. With a three cylinder locomotive the crank pin 35^a for the other side of the locomotive will be angularly spaced through 120° from the crank pin 35.

Each of the valve chests 20 is provided with a valve rod 37, and a suitable valve gear is provided for operating and controlling this rod to thus operate and control the valve. I do not limit myself to the use of any particular type of valve gear for this purpose, as there are a number of valve gears which are well known and which are satisfactory. However, in order that my invention may be clearly understood, I have shown and will describe a valve gear of the Walschaert type. As illustrated, there is a lap-and-lead rod 38 which is pivotally connected to the valve rod at 39. A cross-head link 40 pivotally connects the lower end of the lap-and-lead rod 38 with a lug 41 on the cross-head 31. At a point above the pivotal connection 39, the rod 38 is pivotally connected with the front end of a radius rod 42. Pivotally connected with the rear end of a radius rod is a block 43 which is adapted to be adjusted in a segmental slot in a reverse link 44. The reverse link is pivoted to the frame at 45, and at its lower end it is pivotally connected with an eccentric rod 46. This eccentric rod extends rearward to an eccentric crank arm 47 connected with one of the drive wheels, in this case the drive wheel 4. Extending transversely across the locomotive and mounted in suitable bearings on the front frame 1 is a reverse shaft 48 provided with a forward extending arm 49. A link 50 connects the arm 49 with the radius rod 42 so that the position of the radius rod and of the block 43 with respect to the reverse link can be changed. The reverse shaft also carries an operating arm 51 which is connected with a reach rod 52. The reach rod is usually connected with a suitable power reverse mechanism (not shown) whereby the reverse shaft can be adjusted to change the positions of the radius rods. It will be understood that the link mechanism, which I have described, is duplicated on the opposite side of the locomotive, and that both radius rods are operated by the single reverse shaft.

From the foregoing description, it will be apparent that the rod 38, when oscillated by the link 40, serves to reciprocate the valve rod 37. This motion, however, is modified and controlled by the endwise motion which the radius rod receives from the reverse link 44. When the radius rod is in its central or neutral position, as shown, it has no endwise motion. When the rod is raised or lowered, varying amounts of endwise motions are obtained, and the varying extents and different directions of this motion serve to regulate the flow of steam to the cylinders 19, 19, and also serve to reverse the direction of travel of the locomotive.

The third cylinder 21 is provided with a piston rod 53 and a cross-head 54 travelling on a cross-head guide 85. The cross-head guide is inclined in accordance with the inclination of the cylinder and valve chest. A connecting rod 56 extends from the cross-head 54, and engages one of the axles which is provided with a suitable crank 57. As shown, the third axle 8 is the one which is cranked. The axes of the two crank pins 35 and 35^a, and the axis of the crank 57 are uniformly spaced circumferentially so as to uniformly apply the power of the three cylinders to the drive wheels. When the third axle from the front is cranked, as shown, it is usually necessary to provide the second axle 7 with an offset or crank 58 so as to provide clearance for the connecting rod 56.

The valve chest 22 for the third cylinder is provided with a valve rod 59, and in accordance with the invention I provide an improved and novel valve gear for operating this valve rod 59. The available space is limited, inasmuch as the axles 7 and 8 are not

available for operating the valve gear by reason of the fact that both of them are cranked. As a practical matter therefore, it is necessary to operate the valve gear from one of the other axles, preferably the first axle 6. I have found that the valve rod 59 can most satisfactorily be operated by a valve gear of the Stephenson type modified and adapted for the peculiar conditions incident to a three or five cylinder locomotive.

Mounted on the axle 6 at one side of the center are two eccentrics 60 and 61. These eccentrics are engaged by eccentric straps 62 and 63 which are connected respectively with eccentric rods 64 and 65. These rods are pivotally connected with a reverse link 66, having a segmental slot 67 therein. A block 68 is relatively movable in this slot 67, the block being pivotally connected with a radius rod 69. The rear end of the radius rod is suspended from the front frame 1 by means of a link 70, and the front end of the radius rod is directly pivoted to an oscillating lever 71.

For vertically adjusting the reverse link 66 there is provided a transverse reverse shaft 72, supported at one end by a bearing bracket 73 carried by the cross-head guide 55 and at the other end by a bearing bracket 74 carried by the cross-head guide 32. The reverse shaft 72 is provided with a rearward extending arm 75 which is connected with the reverse link 66 by means of a link 76. The reverse shaft 72 is also provided with an arm 77 which is connected by means of a link 78 with an arm 79 on the main reverse shaft 48.

The lever 71 is of peculiar construction and mounting, and has certain important advantages. The reverse link 66 and the radius rod 69 are necessarily located between the side members of the front frame 1; but the valve rod 59 to be operated is located at one side of the front frame as clearly indicated in Fig. 4. The motion of the radius rod must, therefore, be transmitted laterally from the vertical plane thereof to the vertical plane of the valve rod. Furthermore, on account of practical limitations the space immediately below the upper element of the side member of the front frame is required for other parts, such as an equalizing spring or an equalizing lever. The pivotal mounting for the lever 71 cannot, therefore, be mounted below the said top member. To attempt to locate the pivotal mounting entirely above the said top member would not give the proper proportion of leverage between the upper and lower parts of the lever. To avoid such difficulties I have so constructed the lever and its mounting that the pivotal axis extends directly through the said top member of the frame, the lever having its lower arm 71^a located at the inside of the frame member and its upper arm 71^b located at the outside of the frame member. These two arms 71^a and 71^b are connected respectively with the radius rod 69 and with the valve rod 59.

For supporting the rock lever 71, there is provided a bearing bracket 80 which is supported in part on the main frame, and in part on the transverse guide support 33, as clearly shown in Figs. 5, 6 and 7. It will be noted that the bracket has a forward extending lug 81 which partly surrounds the top element of the frame member, and is provided at its sides with aligned inward tapering openings. The bearing bracket 81 is also provided with lugs 82 and 83 located on opposite sides of the lug 81, and spaced therefrom. These lugs have apertures registering with the beforementioned apertures in the lug 81. The rock lever 71 is formed to embrace the lug 81, and the opposite parts thereof fit between the outer sides of the said lug 81 and the inner sides of the said lugs 82 and 83. Bearing pins 84 and 85 fit the beforementioned apertures in the lugs 81, 82 and 83, and extend through suitable bearing apertures in the sides of the rock lever 71. These pins 84 and 85 are tapered at their inner ends to fit the tapered apertures in the lug 81, and preferably a draw bolt 86 extends through central holes in the two bearing pins and also through a hole in the top element of the frame member. This draw bolt is provided with a nut by means of which the draw bolt serves to force the two bearing pins toward each other, and into the tapered apertures in the lug 81. Thus the two pins 84 and 85 are held firmly in place and provide a rigid bearing support for the rock lever. The pivotal axis extends through the top element of the frame member, but any weakening of the said top member is avoided.

The bearing bracket 80 may also have other functions. As shown, it is provided with a bearing pin 87 which may serve to support a brake hanger (not shown).

From the foregoing description, it will be seen that the reverse link 66 is operated by the eccentric rods 64 and 65 in the usual way. The radius rod 69 is given the usual longitudinal movement which is transmitted to the valve rod 59 by means of the rock lever 71. This motion is modified and controlled in the usual way by raising and lowering the link, this raising and lowering being effected by means of the rock or reverse shaft 72 and the parts associated therewith. It is to be particularly noted that the reverse shaft 72 is operated from the main reverse shaft 48 so that the reverse links for all three of the valve gears are moved in unison. In this way the single reach rod 52 serves to operate and control the valve gears for all three cylinders.

In Figs. 8 and 9 I have shown an alternate embodiment of the invention, wherein the Stephenson valve gear is actuated by the axle 9^a at the rear of the cranked axle 8^a. Mounted on the said axle 9^a at one side of the center

thereof are two eccentrics 88 and 89. These eccentrics are engaged by eccentric straps 90 and 91 which are connected with eccentric rods 92 and 93. These rods are pivotally connected with a reverse link 94, having a segmental slot 95 therein. A block 96 is relatively movable in this slot 95 and the block is carried by the lower end of a rock lever 97, which is the same as or similar to the rock lever 71.

For vertically adjusting the reverse link 94 there is provided a transverse rock shaft 98 connected by means of an arm 99 and a link 100 with the main reverse shaft 101. The rock shaft 98 is provided with a forward extending arm 102 which is connected with the reverse link 94 by means of a link 103. The link 94 is thus connected to be adjusted simultaneously with the adjustment of the valve gears for the outside cylinders.

The construction and mounting of the rock lever 97 are substantially the same as for the rock lever 71 and repetition of the description is unnecessary. The lever has a lower inner arm 97^a which carries the block 96 and an upper outer arm 97^b which is connected with the valve rod 59^a for the third cylinder. I have shown a series of links 104 interposed between the lever arm 97^b and the valve rod, but I do not limit myself to the construction shown.

What I claim is:

1. The combination in a valve mechanism for a locomotive of side frames, a valve, a valve gear of the Stephenson type for operating the valve, the mechanism of the gear being located between the frames, a rocking lever for the gear; a bearing bracket for the lever having a lug engaging both sides of the top element of a side frame; and two opposed bearing pins for the lever extending into apertures in the side lug at the opposite sides of the frame.

2. The combination in a valve mechanism for a three cylinder locomotive, of side frames; a valve gear mounted between the frames for operating the valve of the central cylinder; a bracket having a pair of lugs extending on each side of one of said frames; a rock shaft having two arms extending on each side of said side frame and between the lugs; bearing pins carried by the lugs, each pin extending through an arm of the lever; and a draw bolt extending through both pins and through a hole in the frame.

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