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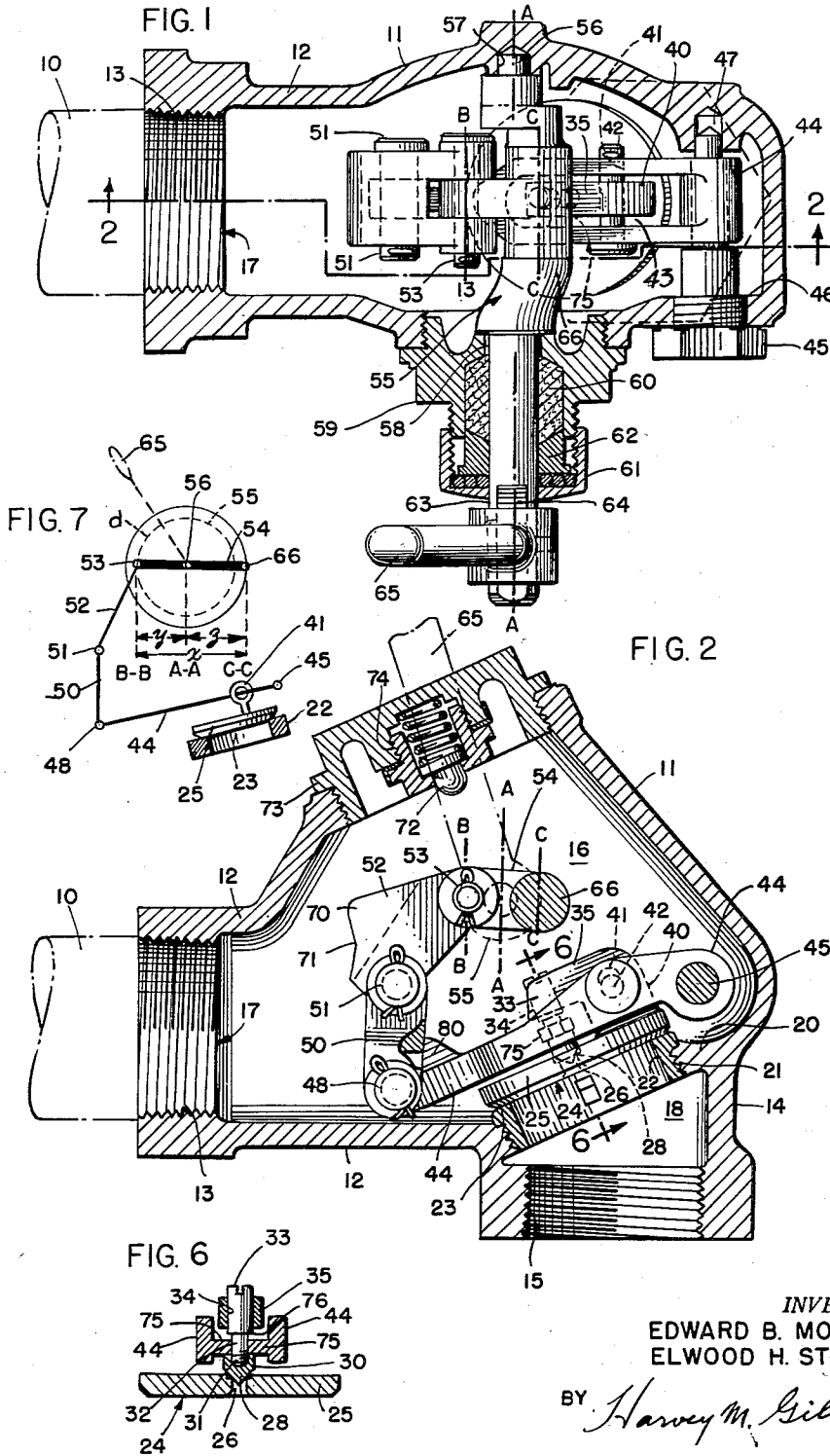
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TRAIN LINE END VALVE

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2 Sheets-Sheet 1



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TRAIN LINE END VALVE

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The present invention relates to steam train line end valves for steam car heating systems. Car heating systems of the type to which the present end valve is applicable have associated therewith a train line in the form of a supply pipe which extends the entire length of the train. The train line sections are connected together by steam couplers between adjacent cars and the individual sections have branch steam connections leading to the heating pipes within the respective cars. Each end of the train line section of each car is provided with an end valve of the type to which the present invention relates and the various valves between adjacent cars are maintained open when the cars are connected in a train with the steam couplings in place. Only the valve at the rear end of the train will be closed.

Inasmuch as an appreciable amount of condensation will take place in the line, it is desirable to allow this condensation to escape to the atmosphere at the rear end of the train. If no provision is made for the escape of such condensation, during cold weather there is danger of its freezing with its attendant serious trouble. However, if the steam pressure is maintained in the line throughout its entire length and the rearmost end valve is allowed to "bleed" a small amount of steam continuously through the rear hose coupling, this trouble is avoided. The present train line end valve makes provision for such bleeding of steam from the rear hose coupling, utilizing a novel form of mechanism for accomplishing this purpose.

In the type of end valve now in general use, a lever is pivoted at one end within the valve casing and has its free end connected through a linkage system to the free end of a crank arm carried on a transverse rock shaft which overlies the main valve element. This latter element is connected to a medial region of the lever so that manipulation of the rock shaft may control the opening and closing movements of the valve.

The principal object of the present invention is to improve the lever and linkage mechanism of such valves in such a manner that a more powerful leverage action upon the valve than has heretofore been possible is attained during the initial opening movements of the valve so that initial "cracking" of the mating valve surfaces may be accomplished by the use of manual force and with but very little exertion on the part of the trainman or other operator of the valve.

Another object of the invention is to provide a valve of the character briefly outlined above wherein the circular valve plate ordinarily associated with valves of this type is pivotally connected to the lifting lever therefor by a connection which not only is closer to the pivoted end of the lever but also is offset radially from the center of the valve plate, thus materially contributing toward a more powerful leverage action but also reducing the force necessary to "crack" the valve at any given head of steam.

Yet another object, in a valve of this sort, is to provide a novel means for shortening the effective length of the

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rock shaft crank arm without appreciably diminishing its stroke so that a more powerful leverage will be exerted on the main valve member to open the same while preserving the full amplitude of movement of the lifting lever.

A similar and related object is to provide a valve construction including main and bleeder valve assemblies wherein the bleeder port provided in the main valve is disposed substantially centrally of the main valve plate and which, although so disposed, will not interfere with the linkage or other mechanism which operates the valve.

Another object is to provide a valve construction of this type wherein the powerful leverage action obtained at the outset when the valve is being opened is subsequently followed by a less powerful but more rapidly operating leverage action which serves to quickly move the main valve member away from its seat and to its final wide open position.

A further object is to provide a valve mechanism of this sort wherein movement of the main valve element from its fully closed position to its fully open position is attained with a minimum amount of turning movement of the rock shaft and consequently of the operating handle which controls the operation of the valve.

Other objects and advantages of the invention, not at this time enumerated, will become more readily apparent as the following description ensues.

In the accompanying two sheets of drawings forming a part of this specification, a preferred embodiment of the invention has been illustrated.

In these drawings:

Fig. 1 is a sectional view taken substantially centrally and horizontally through a train line end valve constructed in accordance with the principles of the present invention and showing the same in its closed position.

Fig. 2 is a sectional view taken substantially along the line 2—2 of Fig. 1.

Figs. 3, 4 and 5 are respective sectional views similar to Fig. 2 showing the valve in progressive stages of opening.

Fig. 6 is a sectional view taken substantially along the line 6—6 of Fig. 2, and

Fig. 7 is a schematic view, geometrical in its representation, illustrating certain principles of leverage employed in connection with the present invention.

Referring now to the drawings in detail and in particular to Fig. 1, the end of a steam train pipe is shown at 10, it being understood that this pipe line will be supported in the usual manner beneath a railway car. The casing 11 of the train line end valve is formed with a rear extension 12 which is internally threaded as at 13 to receive the threaded end of the pipe 10, the valve being supported from this latter pipe. The casing 11 is also provided with a downwardly projecting extension 14 (see also Fig. 2) which is internally threaded as at 15 to receive the end of a flexible pipe coupling (not shown) by means of which the valve casing may be connected to the train line section of an adjacent car. The casing 11 encloses the main steam chamber 16 into which steam flows through the inlet port 17 provided in the extension 12 and from which steam flows through an outlet port 18 provided in the extension 14.

The casing 11 in the vicinity of the outlet port 18 is provided with an internal web 20 internally threaded as at 21 for the purpose of receiving therein a removable main valve seat 22 which is of ring-like design and which is provided with a lapped flat seat surface 23 (see also Fig. 5) designed for cooperation with a similarly lapped flat surface 24 of a main valve member or plate 25 movably supported within the casing 11 in a manner that will be described presently.

The valve member 25 is provided with a relatively small central steam passage 26 at the upper end of which

there is formed an auxiliary valve seat 27 designed for cooperation with a conical valve surface 28 provided on a valve element 30 (see also Fig. 6) threadedly received as at 31 on the lower reduced end 32 of a valve stem 33 slidably supported in a cylindrical bore 34 provided in an overlying extension 35 integrally formed with the valve plate 25.

The passage 26 provided in the valve plate 25 constitutes a bleeder passage whereby steam pressure on the opposite sides of the valve plate 25 when the latter is closed upon the seat 23 may be at least partially equalized to facilitate opening of the valve assembly. With the valve member 25 closed upon the seat 23 as shown in Fig. 2, the head of steam provided in the valve chamber 16 will serve to normally maintain the bleeder valve assembly including the valve element 30 closed upon the bleeder valve seat 28. Means are provided whereby immediately prior to the opening movement of the valve member 25, the bleeder valve assembly may be lifted from its seat and, toward this end, mechanism which will be described subsequently is associated with the main valve lifting instrumentalities. This valve lifting mechanism may also be employed during adverse cold weather conditions to maintain the valve element 30 elevated from its seat 28 to allow a small amount of steam to bleed from the chamber 16 and through the rear-most hose coupling to carry with it any condensate which may have collected in the exposed valve.

The overlying extension 35 which slidably supports the bleeder valve assembly is integrally formed on a vertically projecting lug or pillar 40 in which there is formed a vertical slot 41. A transverse pin 42 projects loosely through the slot 41 and bridges an opening 43 provided in a yoke member 44 one end of which is pivotally supported on a retaining pin 45 threadedly received as at 46 in a wall of the casing 11 at one end and supported at its other end in a socket or recess 47 provided for it in the casing 11. The yoke 44 extends forwardly in the chamber 16 and has its free end pivotally connected by means of a retaining pin 48 to a bifurcated end of a short link 50, the other end of the link being pivoted by means of a retaining pin 51 to the bifurcated end of a second link 52. The other end of the link 52 is also bifurcated and is pivotally connected by means of a retaining pin 53 to the free end of a relatively short crank arm 54 integrally formed on a rock shaft 55 of special design and which rock shaft embodies certain novel features which constitute a part of the present invention as will be set forth in detail subsequently.

The rock shaft 55 extends transversely through the steam chamber 16 and is journaled in the opposite side walls of the casing 11. At one end the shaft 55 is formed with a reduced stud 56 (Fig. 1) which extends into a journal socket 57 formed in one casing side wall. At its other end, the shaft 55 extends through and is journaled in a bearing 58 formed in a plug 59 screwed into the opposite casing side wall. The plug 59 encloses a suitable packing material 60 which surrounds the shaft and a cap member 61 threaded on the plug serves to force a gland 62 against the packing material 60 to form a steam tight joint about the rock shaft 55. The free projecting end 63 of the rock shaft 55 is squared as at 64 or is otherwise of non-circular cross section to accommodate a suitable operating lever 65 by means of which the rock shaft may be manipulated.

The rock shaft 55 is disposed above the main valve plate 25 generally to one side thereof and the medial regions of the shaft within the chamber 16 is formed with an offset portion 66 which is slightly removed from the pivotal axis $a-a$ of the shaft as clearly shown in Fig. 1. The crank arm 54 is cast integrally or is otherwise formed on the offset portion 66 substantially centrally thereof and extends radially outwardly therefrom in the direction of the pivotal axis of the shaft and is slightly greater in length than the distance existing be-

tween the axis of the offset portion 66 and the pivotal axis $a-a$ in order that certain principles of leverage associated with the present valve linkage mechanism may be effectively carried out in a manner that will be described presently.

The double ended bifurcated link 52 is formed with a transverse bridge or crown portion 70 presenting an upwardly facing depression 71 designed for cooperation with the lower end of a spring-pressed plunger 72 mounted in a closure plug assembly 73 threadedly received in an opening 74 provided in the casing 11. The lower end of the plunger 72 is rounded and is designed for locking cooperation with the depression 71 provided in the crown portion 70 of the link 52 when the valve is in its open position as shown in Fig. 5.

The previously mentioned means for lifting or opening the bleeder valve assembly 30, 32 from its seat 27 on the circular valve plate 25 comprises a pair of lifting fingers 75 formed on the side arms of the yoke member 44 and which project inwardly of the opening 43 in the yoke member in opposed relationship and underlie the shoulder 76 afforded by the reduced end 32 of the valve stem 33. It will be seen therefore that an initial movement of the elongated yoke member 44 from its lowermost position illustrated in Fig. 2, prior to movement of the valve plate 25 away from its seat 23, will cause the opposed fingers 75 to engage the shoulder 76 and elevate the valve stem 33 to thus lift the valve element 30 from its seat 27.

In the operation of the train line end valve, when the valve is closed the various operative parts thereof will assume the positions shown in Fig. 2 wherein the circular valve plate 25 is seated upon the valve seat 22 with the operating lever being elevated to such a position that the plate 25 is free to seat itself properly. If the train line contains steam the valve plate is maintained in its seated position by the steam pressure within the chamber 16. Initial swinging movement of the operating lever 65 in a clockwise direction from the position shown in Fig. 2 will cause the free end of the crank arm 54 to move upwardly from the position which it assumes in Fig. 2 to the position shown in Fig. 3 and will exert a pulling effect on the free end of the elongated yoke member 44 and cause the same to swing in a clockwise direction about the axis of the pivot pin 45. During this initial movement of the yoke member 44, the bleed valve assembly will become open by virtue of the lifting action of the lifting fingers 75 as previously described and during such opening movement the main valve 25 will not be moved from its seated position since the pin 42 carried by the yoke member 44 will simply move upwardly within the larger slot or opening 41 provided in the pillar 40 of the valve plate 25. The volume of steam thus bled through the port 26 provided in the valve plate may be regulated to some extent by regulating the threaded extent of the valve element 30 on the reduced stem 31 to attain earlier or later valve movement as the case may be. In the form of the valve illustrated herein, an initial movement of the operating lever 65 throughout an angle of approximately 20° will serve to open the bleeder valve without creating any movement of the main valve plate 25. The lever may be left in this position and the friction of the valve-operating connections will ordinarily be sufficient to hold the bleeder valve open.

After the bleeder valve assembly has been opened as just described, continued downward movement of the operating lever 65 and consequent upward swinging movement of the yoke member 44 will cause the retaining pin 42 to engage the upper end of the slot 41 and exert a lifting movement upon the valve plate 25 as a whole and cause the same to be moved away from the seat 22. Such initial movement of the valve plate 25 is greatly facilitated by the relatively large mechanical ad-

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vantage of the applied leverage on the plate through the linkage mechanism, as well as by the partial equalization of fluid pressure on the opposite sides of the plate which takes place due to the bleeding action of the bleeder valve mechanism.

The leverage action just referred to is geometrically portrayed in Fig. 7 which should be considered in connection with Figs. 1 and 2. In Fig. 1 the axis of swinging movement of the operating lever 65 is designated by the broken line $a-a$. The shiftable axes $b-b$ and $c-c$ represent the axes of the retaining pins 51 and 53 respectively. The dotted circle d in Fig. 7 represents the cross sectional outline of the rock shaft 55 at one pivoted end thereof. These designations $a-a$, $b-b$ and $c-c$ have been maintained in Fig. 7 to illustrate the horizontal distances existing between the various pivotal axes. Despite the fact that the crank arm 54 which projects radially outwardly from the offset portion 66 of the rock shaft 55 has a linear extent x , the effective lifting action on the yoke 44 as applied by manipulation of the handle 65 is the result of a mechanical advantage which may be represented by the expression l/y where l is the length of the handle 65 and y is the difference between the length x of the crank arm 54 and the length z which is the extent of offset of the portion 66 of the shaft 55, it will be observed that in the absence of any offset portion and, considering only a straight operating shaft extending through the casing 11, the displacement of the pivot point 53 from the turning axis $a-a$ of the shaft is so slight that it would be impracticable to devise a suitable lug or other attachment point for the link 52 due to its close proximity to the axis $a-a$. Furthermore, since the auxiliary bleeder valve instrumentalities are centered with respect to the main circular valve plate 22, the offset portion 66 of the shaft 55 provides a clearance for these valve instrumentalities so that they may function properly without interference by the rock shaft. As will be set forth presently, the offset portion 66 of the shaft has a third function in the operation of the valve structure wherein, after initial opening of the main valve 22 has taken place, continued turning movement of the rock shaft 66 causes the main valve 22 to be rapidly carried away from its seat to fully open the valve with a minimum amount of turning movement of the shaft being required to effect such full opening.

Referring now to Fig. 3 in conjunction with Fig. 7, it will be seen that after the valve has been broken from its seat under the influence of the powerful leverage exerted by the crank arm 54, the links 50 and 52 assume progressively greater inclinations with respect to each other and the pivot pin 53 is pulled upwardly and toward the right so as to continue to pull the free end of the yoke 44 upwardly and gradually increase the extent of opening movement of the valve plate 22. When the operating lever 65 assumes the position shown in Fig. 4, the upper side of the offset portion 66 will come into contact with the underneath side of the link 52 whereupon this link and the rock shaft 55 will turn as a unit so that the lifting force is applied directly to the upper end of the lower link 50 and the free end of the yoke 44 is rapidly pulled upwardly to move the valve plate 22 to its open position shown in Fig. 5. At some time in between the position of the valve parts shown in Fig. 3 and the position shown in Fig. 5, a laterally projecting lug 80 formed near the forward end of the yoke 44 will engage one side of the link 50 so that the yoke and link "go solid" so to speak and prevent collapsing of the link 50 upon the yoke. This positive engagement between the yoke 44 and link 50 which limits the further collapsing movement of these two parts still further shortens the arcuate distance through which it is necessary to move the operating handle to effect complete opening of the valve 22. The provision of the lug or

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abutment 80 has an additional function in that it maintains the link 50 extended from the yoke 44 in a predetermined distance so that the upper link 52 is brought into engagement with the spring-pressed locking pin 72 and the latter pin is caused to move into register with the depression 71 at the precise time when the valve plate 22 attains its fully open position. In this regard it is to be noted that since the lower end of the locking pin or detent 72 is rounded, it will be engaged by the apex of the link 52 and will ride inwardly on the surface 70 until such time as it moves into register with the depression 71.

The valve may be closed by imparting a counter clockwise rotation to the rock shaft 55 through the medium of the operating lever 65, the detent 72 yielding to prevent the link 52 to move out of contact therewith. Thereafter the various parts will move by virtue of their own weight and the unbalanced forces associated therewith to the closed position, assisted possibly by the pressure of steam progressively built up in the chamber 16 as the valve plate 22 approaches its closed position.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification since various changes in the details of construction may be resorted to without departing from the spirit of the invention. Only insofar as the invention has been particularly pointed out in the accompanying claims is the same to be limited.

We claim:

1. An end valve structure for a railway car steam train line, said structure comprising a casing defining a valve chamber and inlet and outlet ports communicating therewith, a main valve positioned in said casing to open and close said outlet port, and power multiplying operating means for opening said main valve comprising a valve lever pivoted at one end to the casing and at an intermediate position to said main valve, a rock shaft mounted in said casing above the valve to oscillate about an axis extending transversely of said lever and is formed with a portion which is radially offset in one direction relative to the oscillatory axis of the rock shaft, a crank arm formed on said offset portion with its free end extending radially therefrom to a position slightly beyond the said axis of the rock shaft, means for operatively connecting the rock shaft to the free end of said valve lever comprising a pair of pivotally connected links, one of which is connected to the free end of said valve lever and the other of which extends into the space defined by said offset portion of the rock shaft and is pivotally attached to the free end of said crank arm.

2. An end valve structure according to claim 1 characterized in that the connection of the crank arm with one of said links is at a location slightly spaced from said axis of the rock shaft, whereby the effective length of the crank arm is relatively short.

3. An end valve structure as defined in claim 1 characterized in that said main valve is provided with a bleeder port therethrough, a bleeder valve for closing the bleeder port is slidably mounted on the main valve, and in that main valve lever has a lost motion connection with said bleeder valve and the main valve, whereby said bleeder valve is opened prior to the opening of said main valve.

4. An end valve structure as defined in claim 3 wherein said lost motion connection between the main valve and said main valve lever is offset relative to the vertical center of the main valve.

5. An end valve structure according to claim 4 characterized in that the offset connection between the main valve and its operating lever is located intermediate the center of the main valve and the pivotal axis of its operating lever.

6. An end valve structure as defined in claim 1 characterized in that the offset portion of the rock shaft,

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during a portion of its movement, abuts against a portion of the link which is connected to the crank arm, whereby this link and the rock shaft are held against angular movement relative to each other during further arcuate movement of the rock shaft in a direction to open the main valve.

7. An end valve structure as defined in claim 6 characterized in that means are provided for limiting the pivotal arcuate movement of the link which connects with the main valve operating lever.

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8. An end valve structure according to claim 7 characterized in that said means for limiting the arcuate movement of the link connected with the main valve operating lever is a lug formed on said main operating lever in a position to engage said connecting link.

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