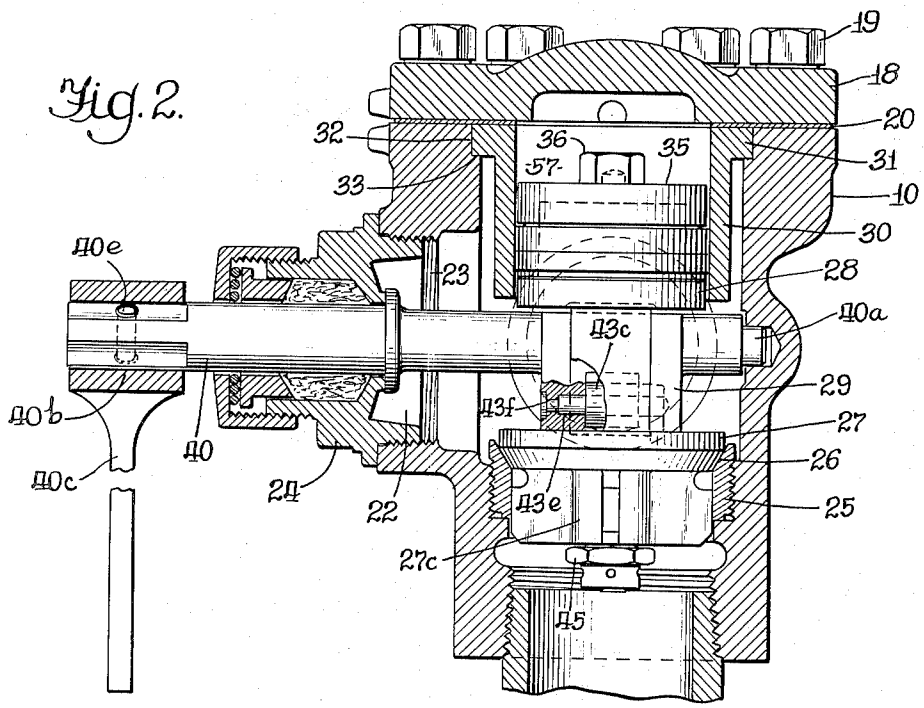
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END VALVE FOR STEAM TRAIN LINE

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Fig. 2.



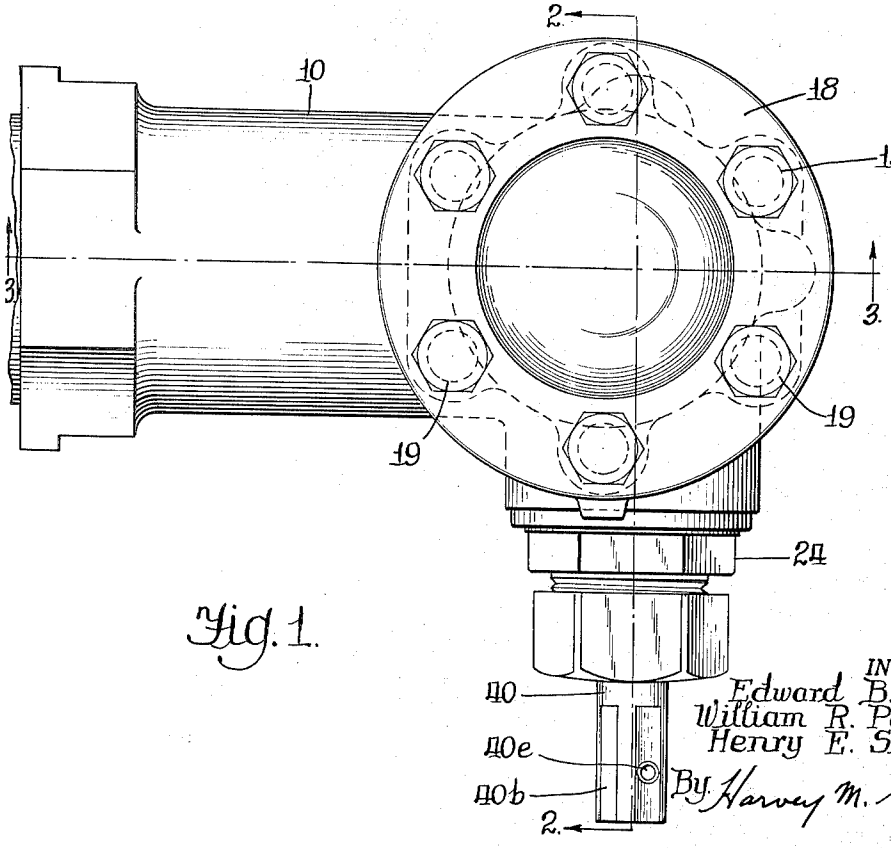


Fig. 1.

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Fig. 3.

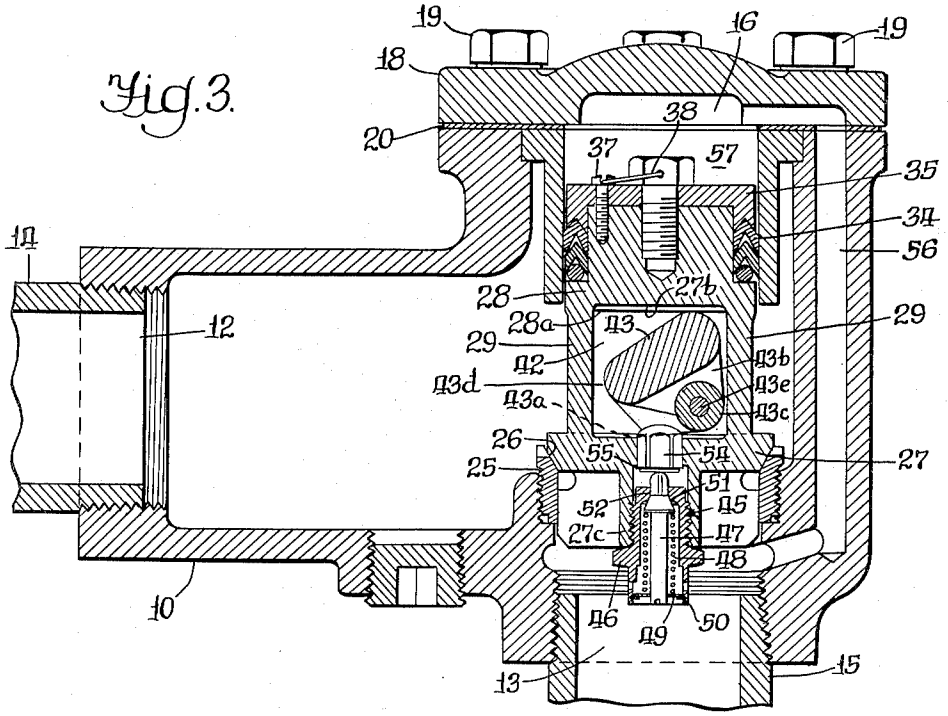


Fig. 4.

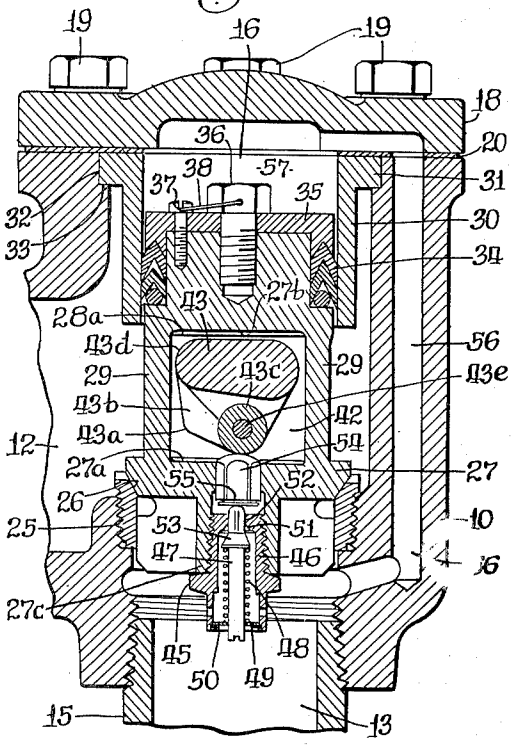
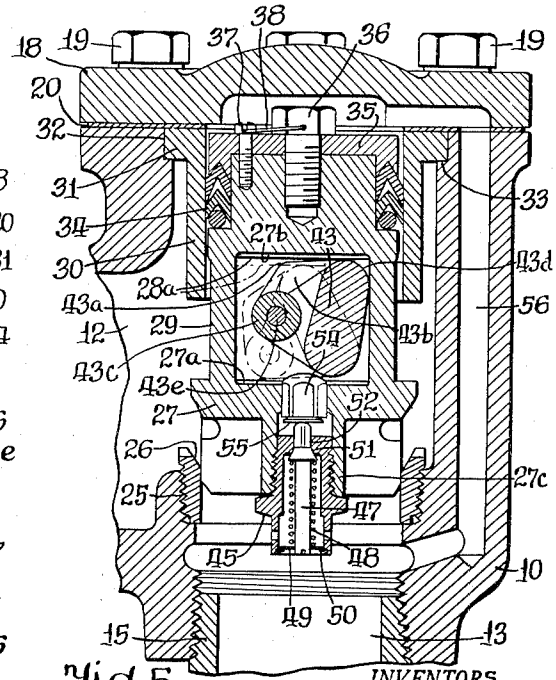


Fig. 5.



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END VALVE FOR STEAM TRAIN LINE

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Application December 24, 1951, Serial No. 263,038

7 Claims. (Cl. 137—630.15)

This invention relates to fluid control valves, and especially high pressure valves. More specifically, it has to do with an improved valve for connecting together the steam train line of adjacent elements of a railway train.

Each car of a railway passenger train has a steam line extending from end to end of the car and each end of the steam line is equipped with a shut-off valve, commonly known as an end valve. A flexible conduit connection ordinarily connects the outlet port of one valve with an inlet port of a valve on the next adjacent car of the train. It will be manifest, therefore, that each side of each end valve may be the high pressure side at one time and at other times the low pressure side depending upon the manner in which the cars are connected to the source of the high pressure steam supply. It will also be apparent that the valve at either end of a car may be required to function as the end valve of the train.

In order to deliver enough steam to the rear cars of a long train it is necessary to use high pressure steam. The present invention, therefore, is directed to improvements which facilitate manual operation of the valves for controlling the passage of high pressure steam between adjacent cars which when the valve is located at the end of the train, it will be held closed by a moderate pressure so as to insure firm pressure of the valve against its seat and which will also discharge condensation through the closed valve at the end of the train and bleed a small quantity of steam therefrom to prevent freezing of the discharged condensate during cold weather.

According to the present invention, the valve is fully balanced for movement of steam into a train pipe of a car and therefore prevents violent percussive action of the valve when it is opened or closed during the presence of high pressure steam. However, when the steam train pipe of a car constitutes the high pressure side of the valve and the flexible connection leading to an adjacent car constitutes the low pressure side, the opening of the valve is resisted by only a moderate pressure which is sufficient to hold the valve closed but can be overcome manually and will not produce violent percussive movement of the valve when it is moved from one position to another.

Further improvements include provisions whereby when the valve is closed, the valve operating means may be moved to a position to open an auxiliary bleed valve and thereby facilitate the discharge of condensation from the valve at the end of the train as well as a small quantity of steam to prevent freezing of the condensate in cold weather. The construction also provides means for reducing friction and consequent wear of the parts which control the extent of opening of said bleed valve.

In the drawings:

Fig. 1 is an external plan view of an end valve embodying the novel features of the subject invention;

Fig. 2 is a section taken at line **2—2** of Fig. 1;

Fig. 3 is a section at line **3—3** of Fig. 1; and

Figs. 4 and 5 are fragmentary sectional views corresponding to a portion of Fig. 3 but showing the valve actuating cam in successive positions.

From what has already been said it should at once be understood that the end valve illustrated is designed for attachment to the steam line of a railway passenger car

or the like, and that one such valve is provided at each end of the steam line, which is to say, at each end of a car or locomotive unit of a train.

The valve comprises a cast housing **10** having ports **12** and **13** internally threaded for connection to pipes **14** and **15**. The pipe **14** may be regarded as extending from end to end of the car and as provided with a second end valve at its other extremity, which second end valve may be a duplicate of that illustrated. The pipe **15** may be considered also to be connected to a flexible conduit coupling device, not shown, for joining the steam lines of adjacent cars. However, there is no inherent reason why the converse could not be true. That is to say, it would be entirely feasible to construct the valve casing with aligned inlet and outlet port so that either port may be connected to the pipe **14**.

The housing **10** has a large opening **16** to permit insertion of internal parts hereinafter described, which opening is closed by a removable cover plate **18** secured in place by cap screws **19**. A steam-tight gasket **20** is interposed between the housing and cover plate. Another opening **22** in the housing **10** (see Fig. 2) is in quadrature to the ports **12** and **13** and is internally threaded to receive a stuffing box **24**.

An annular insert **25** having a tapered valve seat **26** is axially aligned with a reciprocable valve element **27** having a complementary tapered valve surface. Four symmetrically arranged guide fins fit slidably within the bore of valve insert **25** and provide lateral support for the valve element, thus serving to keep it in alignment with the valve seat. A piston **28** cast integrally with the valve element **27** and connected thereto by two laterally spaced parallel struts **29** fits slidably in the bore of a cylindrical sleeve **30** having an external flange **31** centered in a counterbore **32** of the housing and is firmly held against an annular shoulder **33** by the cover plate **18**. The piston is reduced in diameter to accommodate suitable packing rings **34** which are held under compression by a clamping cap **35** detachably secured to the piston by a cap screw **36** and locked against rotation by a fillister head screw **37**. Both screws are, in turn, locked against loosening by a wire loop **38** which is threaded through suitable holes in the two screw heads.

A cam shaft **40** passes through the stuffing box **24**, as shown in Fig. 2, and has its interior end, **40*a***, journaled in the housing so that the axis of rotation of the cam extends transversely of the main axis of the main valve element and is positioned at one side of said main axis. The exterior end **40*b*** of the cam shaft is square-sectioned to receive an operating handle or wrench **40*c***. The latter may, if desired, be fixedly attached to the cam shaft and secured by a pin through the pin hole **40*e***. The cam shaft extends through the rectangular clearance space **42** between the struts **29**, and between the piston and valve element, and has a cam portion **43** which is operative to reciprocate the unit comprising valve element **27** and piston **28** in response to rotation of the cam shaft for opening and closing the valve. The cam **43** will be further discussed later on.

The valve element **27** has an integral hub **27*c*** internally threaded to receive a bleeder valve assembly **45** consisting of an externally threaded body **46**, a needle valve **47**, a valve spring **48**, a washer **49** and snap ring **50**. The body **46** has an axial bore which is constricted at one end to provide a shoulder forming a tapered valve seat **51** and an opening **52** which serves as a steam passageway and at the same time as a guide for the pilot tip of the needle valve **47**. The latter has a frustro-conical enlargement **53** designed to engage the valve seat **51** and is normally held in engagement therewith by the spring **48**. The washer **49** functions as an abutment for one end of spring **48** while the other end of the spring bears against a

shoulder on the needle valve. The snap ring **50** is seated in an annular groove formed in the body **46** and serves as a retainer and abutment for the washer. An actuating button **54** fits slidably in an opening in the valve element **27** and is of non-circular, preferably hexagonal, cross-section so as to provide ample clearance for passage of steam thereby. A snap ring **55** on the actuating button serves as a retainer therefor. The actuating button engages the nose of the needle valve and functions to depress the same when actuated by the cam, thus opening the bleeder valve. The needle valve could be actuated directly by the cam, that is to say without interposition of the actuating button; but it makes for better mechanical design to provide the button.

A passageway **56** connects the cylinder chamber **57** with the port **13**; and since the diameter of the piston is substantially equal to the effective diameter of the valve element **27**, when the valve is closed, it will be evident that when the high pressure is on that side of the closed valve wherein it tends to force the valve element **27** off its seat, it is fully or substantially counterbalanced by the opposing pressure exerted by the piston. In that situation very little force is required either to open the valve or to hold it closed. On the contrary, when the high pressure is on the other side of the valve, which is to say the port **12** side, there is a moderate steam pressure exerted on the valve in a direction to hold it closed. This is due to the fact that the top surface **27***a* of the valve is slightly larger than the opposing surface **27***b*. This, of course, tends to make it necessary to apply a correspondingly larger force to open the valve, but the out-of-balance is moderate, for example about 20 pounds, and the valve can be manually opened against this pressure.

When the valve is closed, the cam occupies the angular position in which it is shown in Fig. 3 wherein its portion **43***a* engages the adjacent flat surface of the valve element **27** and wherein the pressure of the steam serves to hold the valve closed. Th cam is relieved at **43***b* to clear the actuating button **54**, so that the bleeder valve is closed when the main valve is closed. A roller **43***c* is mounted in the relieved portion **43***b* so as to contact the button **54** and force the bleeder valve open before the main valve **27** is moved off its seat. This is clearly depicted in Fig. 4 wherein it will be seen that the bleeder valve is open as a result of the cam having been rotated through a few degrees, the main valve being still closed. The bleeder valve is opened in all cases preliminary to the opening of the main valve. This feature is highly important when the valve is at the end of the train, since its intermediate position (shown in Fig. 4) provides an outlet for condensation and also permits the discharge of a small amount of steam to prevent freezing of the condensate in cold weather. However, during the opening of the main valve the cam does not come to a standstill upon reaching the angular position of Fig. 4 but continues its rotation without interruption. Thereupon the curvilinear cam surface **43***d* moves into engagement with the flat surface **28***a* of the piston and thus proceeds to force the main valve element **27** off its seat and thence to its fully open position as per Fig. 5. In the latter figure we have shown the cam in dot-dash outline approaching the fully open position and, additionally, in full lines in the extreme open-valve position. It will be apparent that in rotating from one to the other of these two last-mentioned positions, the cam passes through a dead-center position; and it will be further noted that when the cam reaches its extreme open-valve position, Fig. 5, it rests against one of the struts **29**, which latter functions as a stop to prevent further rotation in the same direction. In addition, it will be observed that when the cam is in the extreme open-valve position, its portion **43** assumes an inclined position beyond the vertical center of its axis of rotation as shown in Fig. 5. As a consequence of which fact the cam is firmly restrained, by the weight of the valve **27** and piston **28**, against counter-rotation resulting from vibration.

The roller **43***c* may be mounted in the relief portion of the cam in a suitable manner, for example by means of a shaft **43***e*. The shaft may be locked in its position by displacing the metal in the shaft opening to form a restriction or stake **43***f*.

We claim:

1. A train line valve comprising a housing having two ports and a cylinder portion, a stationary valve seat centrally aligned with said cylinder portion and defining a main passageway between said ports within the housing, a main valve structure including a piston element reciprocable in said cylinder and a main valve element connected with said piston and operable to open and close said main passageway at said valve seat and having top and bottom sides, either of which is selectively usable as a high pressure side of the main valve element, a self-closing bleeder valve carried by said valve element beneath the bottom side thereof and having an end portion projecting through said top side, the bleeder valve being effective, when open, to provide a bleeder passageway through the main valve element, the construction being such that when fluid pressure is applied to the top side of the main valve element it is pressed firmly in its closed position and when high pressure is applied to the bottom side thereof such pressure tends to displace the main valve element from its seat, means defining a duct leading from said cylinder at a location above said piston to a portion of said main passageway below said main valve element, whereby the fluid pressure exerted against the bottom side of the main valve is also exerted against said piston to oppose the aforementioned displacement of said main valve element from its seat, and a manually operable rotary cam for engaging the top surface of the main valve element and having alternate closed-valve and open-valve positions, said cam being provided with a portion for engaging and opening the bleeder valve preliminary to opening the main valve element.

2. A train line valve according to claim 1 characterized in that a friction reducing roller is carried by said cam for engaging and opening said bleeder valve.

3. A fluid control valve according to claim 1 characterized in that the portion of the bleeder valve which projects through the main valve element is engaged by the rotary cam, but the rotary cam is recessed to provide a clearance for said projecting portion of the bleeder valve when the main valve element is in its closed position.

4. A train line valve according to claim 1 characterized in that the said rotary cam is interposed between said valve element and said piston element and is operative to reciprocate them for opening and closing the valve element.

5. A train line valve according to claim 4 characterized in that the rotary cam is movable beyond the vertical center of its axis of rotation and in such position bears against said piston to lock the main valve element open.

6. A train line valve according to claim 4 characterized in that the said cylinder includes a sleeve surrounding the piston and removably clamped to the valve housing.

7. A train line valve according to claim 6 characterized in that the rotary cam is journalled on an axis extending transversely of the longitudinal axis of the valve structure and is located at one side of said longitudinal axis of the valve structure.

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